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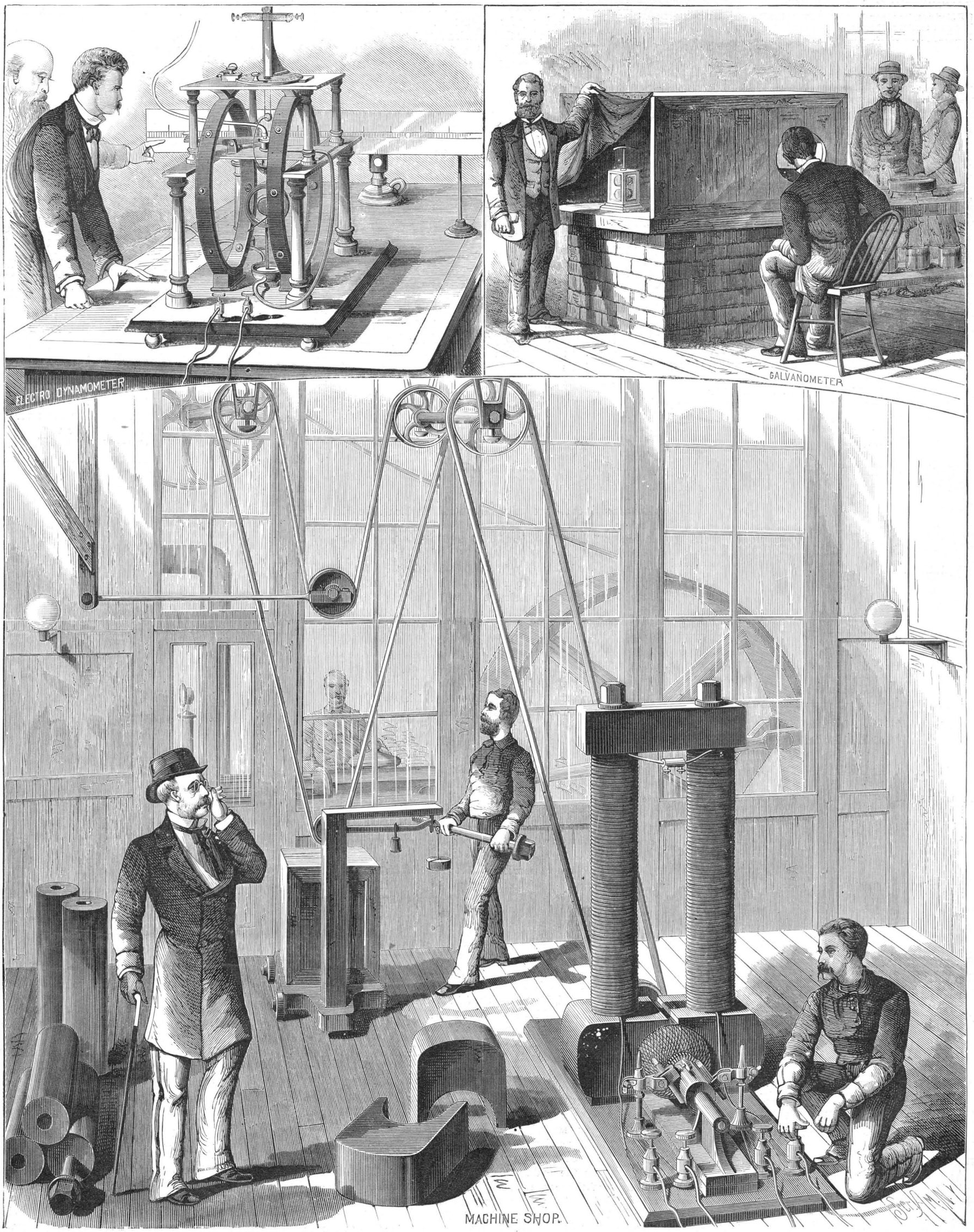

EDISON'S ELECTRIC GENERATOR.—[See page 242.]

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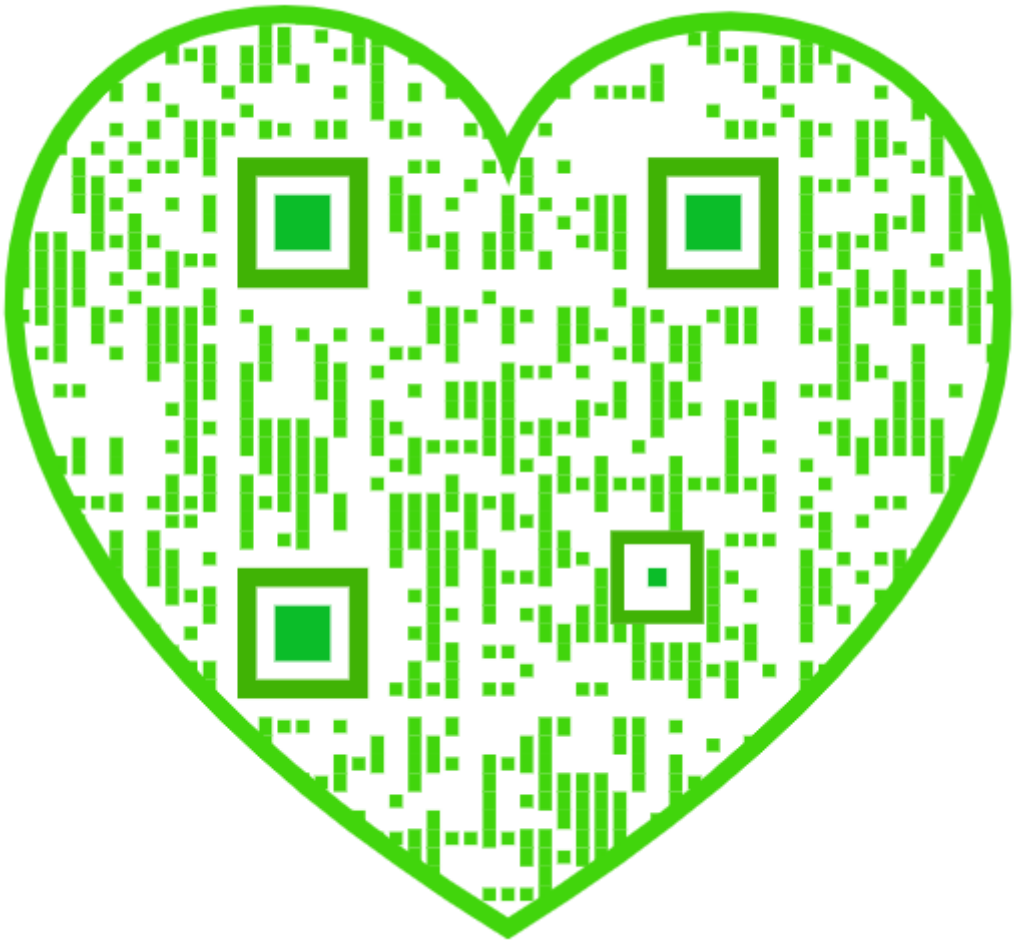

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NEW YORK, SATURDAY, OCTOBER 18, 1879.

Contents.

(Illustrated articles are marked with an asterisk.)

Advertisers, a suggestion to..... 245
Air, warmth of the*..... 245
Arsenic in the brain..... 244
Bicycle race, the last. 244
Boiler coil [2]..... 251
Bromine in the U. S..... 240
Cartridge, Tyler*..... 246
Carving attachment for lathes*.. 244
Chair, barber's, new*..... 246
Chemicals, home..... 244
Chlorophyl 244
Cider, to preserve sweet [14]..... 251
Cinchonidine in quinine [5]..... 251
Cloth, to waterproof [5]..... 251
Concert rooms..... 248
Consumption..... 241
Currents of Ampere..... 244
Decoys for wild fowl*..... 247
Electrical generator, Edison's*.. 242
Elements in nature [26].. 252
Engines, power of [16]..... 251
Enterprise, American..... 250
Errata..... 250
Expedition to the Red Sea..... 250
Famine and disease..... 245
Fires, curiosities of..... 248
Flour mills, horizontal, French... 243
Forging, quick..... 243
Fulminate, to make [18]..... 252
Fusing metals without fire..... 247
Gilt frames, to clean [22]..... 252
Glass, how old is..... 248
Hydraulic ram [8]..... 251
Hydraulic ram, power of [17]..... 252
Ice, medicated... 248
Inventions, agricultural..... 249
Inventions, engineering..... 246
Inventions, mechanical..... 242
Inventions, miscellaneous..... 243
Launch, steam, of light draught.. 249
Lotus, the, in New York..... 248
Locomotive without water..... 241
Mails, disinfection of..... 250
Memory, concerning the..... 247
Metric system, basis of [15]..... 251
Mississippi jetties, work on..... 240
Monsters, ancient, some..... 247
Motive power, England's 241
Non-conductor of heat [15]..... 251
Objective, 32-inch, Russian.. 249
Ore smelting at Leadville..... 249
Oxygenating water [21]..... 252
Paper collargoods, manuf'ture of 245
Paper trade, export..... 244
Patents, American, recent..... 247
Patents, recent decisions..... 245
Photography in wood engraving. 240
Pocketbook, recording*..... 246
Powders, luminous..... 248
Sewing machine patents..... 250
Soluble glass [24]..... 252
Spectacles, use of delayed..... 244
Stripping solution [4]..... 251
Suggestions for discussion..... 250
Tarsier, the*..... 247
Tides, underground..... 241
Torpedo, Lay, the 249
Tortoise shell..... 244
Tunnel, Hudson river..... 240
Varnish for violins [3]..... 251
Water, bad, in Baltimore 241
Water, impure..... 248
Waterproof for paper vessels [11] 251
Wire, experiments with..... 250
Wire, to cover [10]..... 251
Wood pulp making..... 243
Yarn, to soften [23]..... 252
Ye r, successful, a..... 244

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 198,
For the Week ending October 18, 1879.

Price 10 cents. For sale by all newsdealers.

I. ENGINEERING AND MECHANICS.—The Most Economical Speed for Steam Ships of the Navy. By JOHN LOWE, B.A., Eng. U. S. N. 1 illustration.
Orient. The largest steamship ever built in Glasgow.
The French Armor Plated Ship, Admiral Duperre. Illustration of ship, with details of the turrets.
Screws vs. Paddles. Comparative economy. Problems to be solved.
Life Saving Rafts. Grandin's system. Perry's Raft. 4 figures.
Economy of Fuel. Needed improvements in fuel burning.
Sewer Ventilation in Berlin. From Karwisse's report on the sewage systems of Europe.

II. GEOGRAPHY, GEOLOGY, ETC.—An Eastern Oil City. Baku and its petroleum. Russian uses of petroleum as fuel.
The Bradford Oil District of Pennsylvania. By CHARLES A. ASHBURNE. Second Geological Survey of Pennsylvania.

III. ARCHITECTURE.—Anti-fire Construction. By R. G. Hatfield. The havoc of fires. Property destroyed. Loss of life, etc.

IV. ELECTRICITY.—Electricity as a Motive Power. Professor W. E. Ayrton's British Association. Annual Discourse to working men. History of electric motors. Philosophy of electric generation. Conservation and dissipation of energy. Steam engines versus electric motors. Water power versus electric motors. Conditions of electric generation.
Electrical Clocks and Clockwork. By HENRY DENT GARDNER. Bains' electrical pendulum. Shepherd's electrical clock, etc. 13 figs.
On Lightning Protectors for Telegraphic Apparatus. By WM. HENRY PREECE. The "plate" protector. Siemens' arrangement. Superiority of plain over serrated plates.
The Brooks Underground Telegraph Cable.

V. TECHNOLOGY, CHEMISTRY, AND PHYSICS.—Standard Photo Plates. Process adapted by Ferrar & Pauli, Barcelona, Spain.
Quantitative Determination of Cadmium. By F. BEILSTEIN and L. JAWEIN.
Fischer's Pyrometer. 1 figure.

VI. MEDICINE AND PHARMACY.—On the Cure of Consumption. By Dr. JAS. H. SALISBURY.
Notes on Cinchona Bark. By DAVID HOWARD.
An Improved Method of Making Phosphorus Pills. By EDWARD F. CHERRY.
A New Method of Making Tincture of Iodine. By E. F. CHERRY.
A New Test for the Presence of Biliary Coloring Matter in the Urine.

VII. METEOROLOGY AND ASTRONOMY.—Meteors. Theory of Prof. Benjamin Peirce.
Meteorological Register. Instrument used at the Observatory of Montsouris. 6 figures. Regulating barometer. Reading apparatus. Thermograph, etc.
Palisa Comet II. of 1878. Elements and ephemeris.
The Planet Jupiter.

VIII. MAN AND NATURE.—How our Ancestors in the Stone Age made their Implements. By B. B. REDDING.
Is Nest Building an Instinct in Birds? By BENJ. T. LOWNE. A study of ring doves' nest building.
Notes on the Thrushes of Washington Territory. By S. K. LUM.

IX. MISCELLANEOUS.—The late Sir Rowland Hill. Life and labors of the father of cheap postage. 1 figure. Portrait.
Dental Transplanting.
New Mode of Harvesting Wheat.
Distances for Grapes.
Sea Weed. Its composition and uses. Production of isinglass from sea weed.

CONCRETE WORK AT THE SEA ENDS OF MISSISSIPPI JETTIES.

The largest blocks of concrete ever employed in works of marine engineering are those used to give stability to the sea ends of the South Pass jetties, now approaching completion, at the mouth of the Mississippi. Two causes combined to make their adoption an imperative necessity—the entire absence of available rock within a radius of five hundred miles or more, and the enormous force of the waves to be withstood. In an early experiment, masses of rock, in blocks weighing from one to two tons, were placed upon the lower ends of the jetties; but the first gale swept them all away. It was accordingly decided to cap the last 3,800 feet of the east jetty and 2,800 feet of the west jetty with blocks of cement concrete, weighing from twenty-five to seventy-two tons each; the largest artificial blocks used in the protection of the great breakwater at Cherbourg, France, and hitherto unrivaled, weighed only forty-four tons.

In a paper read before the American Society of Civil Engineers, last August, Chief Assistant Engineer Max E. Schmidt gave an account of the mode of constructing and depositing these gigantic blocks, a mode which presents several novel and interesting features.

The concrete is made of broken stone, gravel, sand, and cement from the limestone region near Rose Clair, on the Ohio, 1,300 miles up the river. The stone is broken by hand, all the pieces being small enough to pass through a three-inch ring. The gravel is brought from Prophet's Island, La., two hundred and fifty miles up the river, and ranges in size from 1-30th of an inch to 2½ inches in diameter. The sand, which comes from the islands near the mouth of Pearl River, Miss., is moderately coarse and sharp grained. The cement is Saylor's American Portland Cement, of which over 5,000 barrels have been used. The proportions of these ingredients employed are by volume, 15 parts broken stone, 4·38 parts gravel, 8·28 parts sand, and 3 parts cement. One hundred and sixty-five cubic yards of these materials (dry) make 100 cubic yards of concrete after final induration. The ingredients are mixed with fresh water in quantity equal to about 10½ per cent of the dry material.

The blocks of concrete are constructed in place on the top of the jetties, and are from 16 to 20 feet long, from 5 to 13 feet wide, and from 2½ to 4 feet thick, the dimensions enlarging by offsets as the jetties approach the sea ends. The mixing is done in a 5 ft. 9 in. cubical box made of quarter inch boiler iron, well riveted and strapped with flat and T iron, and supported by a strong framework of timber resting on the jetty. A separate mixer is used on each jetty. The mixer is suspended by two hollow cast-iron trunnions, 7½ inches in diameter, which are riveted from the inside of box to two corners diagonally opposite, so that the box with its contents is easily revolved by a steam engine on the wharf below.

The mixer is charged and discharged through a triangular door, formed by cutting off one corner of the box, the sliding cover being strongly clasped and secured by screws. The water enters the box through hollow journals while the ingredients are being revolved for mixing. The dry materials are handled and lifted by steam power. Twenty-two revolutions of the mixer, requiring about two minutes and a half, suffice to thoroughly incorporate the ingredients. The concrete is discharged into cars beneath, and is quickly drawn to the point of deposition by a small locomotive along a railway running above the surface of the jetty, supported by piles. The cars, which contain about two cubic yards each, are strongly built of boiler iron. By means of two ratchet wheels and wooden levers permanently attached to the axle on each end of the car, the dumping of nearly 9,000 pounds of concrete is done almost automatically, and the car is easily turned back to its upright position by two men. The moulds, constructed almost entirely without nails or spikes, are sawed out in parts and fitted by carpenters, and are carried on trucks over the finished blocks to the place where needed. Then the flooring is laid down and the other parts quickly put in place. As soon as the mould is ready the freshly-prepared concrete is filled in, and the concrete is left to set. Less than twenty minutes are required to transfer the dry material from the wharf to the mixer, to mix the concrete, and transfer it to the mould. Making allowances for rough weather and other causes of delay, an average of 100 cubic yards of concrete is made a day on each jetty. During the earlier part of the construction the concrete was rammed in the moulds, but that process has been abandoned as needless, it having been found that the vertical fall of ten or twelve feet, from the car to the mould, leaves the stuff in a better state of compression than could be obtained by ramming. Four days after the setting has commenced each block is coated with a plastering of mortar, laid on from one to three inches thick, by means of the trowel. This mortar—composed of equal volumes of American Portland cement and sand—is prepared in small quantities and the plastering done quickly. At the end of two weeks the concrete has become hard enough to allow the removal of the moulds, after which the interspaces are filled with mortar or rubble masonry. By far the greater and more difficult part of this concrete work was in place in the fore part of June. At the current rate of progress the main capping would be completed before the end of the month. The plans of the work contemplate the addition of a massive parapet to this capping, the time of beginning it to be determined by the degree of subsidence observed. It is expected that the compression due to the tremendous weight of the blocks will continue until the elasticity of the subaqueous layers of mattresses has been destroyed. The greater part of the settling seems to occur within the first ten days after the construction of the blocks.

USE OF PHOTOGRAPHY IN WOOD ENGRAVING.

In the practice of the ordinary method of wood engraving the artist whitens the surface of the block and makes his drawing thereon with India ink or pencil. The engraver then cuts upon the drawing, endeavoring to keep in mind the general effect of the original; but the latter is of course gradually obliterated as the work of cutting proceeds. To this obliteration of the original drawing is probably due a part of that loss of artistic effect in the finished engraving, of which draughtsmen are apt to complain.

The facilities offered by photography are now, however, being used by engravers and draughtsmen to assist in the production of better engravings. Instead of drawing directly upon the wood, the artist now makes his finished picture upon paper, which is then photographed upon the wood in exact *facsimile;* the engraver then proceeds to cut the photograph, and during the whole time of cutting he has before him the original paper drawing, to which he may refer for assistance in his endeavor to maintain and reproduce the spirit and feeling of the picture.

THE HUDSON RIVER TUNNEL.

The Hudson Tunnel Company, which began excavations almost five years ago for a submarine passage to connect the cities of New York and Jersey City, lately resumed operations after a litigation of several years begun by railroads and private citizens to restrain the work. The courts of New Jersey decided that the company were legally entitled to build their tunnel, and Colonel DeWitt C. Haskin, the President, immediately set to work a force of about fifty masons and laborers at the original point of departure, Jersey avenue and Fifteenth street, Jersey City. The tunnel was begun in November, 1874, after extensive borings which had been begun a year before in the bottom of the Hudson River. A circular working shaft thirty feet in diameter, walled with four feet of brick, was begun 100 feet inland, it being intended to make it 65 feet deep, at which point the tunnel was to be constructed. Colonel Haskin informs the *World* that he expects to get well under the river before winter sets in. It is estimated that the tunnel will cost $10,000,000. It will be 12,000 feet long, including the river approaches, and the greatest depth under water will be over sixty feet. The location of the New York terminus has not been fixed upon, but Washington Square has been suggested. It is now proposed, to gain time, to work at once on each side of the river, as many men to be employed as possible at one time in gangs, which are to be relieved every eight hours. The company claims that by the aid of compressed air, as applied in the patent obtained by Colonel Haskin, it will be able to complete the work at much less expense than any similar work has ever been constructed for. It is believed that its present capital of $10,000,000 will be abundant for that purpose. The plan of construction contemplates no coffer-dam, caissons, or Brunel shields, the compressed air introduced into the face of the tunnel being expected to exert sufficient pressure to hold in place and prevent any irruption of silt, clay, or water. The air pressure is also expected to carry back to the working-shaft through pipes all sand, mud, or water that may accumulate in the heading during the course of the excavation. It is believed that the tunnel can be advanced five feet a day, and that the whole work can be completed in two years.

All this, of course, is contingent upon the success of Col. Haskin's method of tunneling. That it will succeed without radical modifications is highly questionable, indeed altogether impossible, since the air in the tunnel would have to be maintained at a density at least equal to that of the semifluid materials to be supported.

The object of the tunnel (which is to be circular in form, 26 feet wide and 24 feet high) is to establish direct railway connection between New York and the railways having termini at Jersey City—the Erie, Pennsylvania, Delaware, Lackawanna and Western, and New Jersey Central. It is estimated that more than 400 trains of cars could be passed through the tunnel every twenty-four hours, the time of travel from Jersey City to Broadway to be six minutes.

THE PRODUCTION OF BROMINE IN THE UNITED STATES.

The only important source of bromine in the United States is the liquid which remains after the extraction of salt, and which is known in the salt-making industry as the "mother waters." The *Moniteur Scientifique* gives a short description of the process employed in separating this important element from the saline liquors. The latter, when first pumped up from the pit, mark 9° Baumé. They are evaporated in long iron boilers to 15° Baumé, allowed to settle, then further evaporated to the crystallizing point in wooden tubs heated by steam. The first crystallization forms the salt of commerce. The tubs, five in number, are placed side by side, and every day the liquor is decanted from one to another—from No. 1 to No. 2, then to No. 3, and so on to No. 5. The crystallized salt is removed from each tub after draining off the liquid. When the brine reaches tub No. 5 it has become mother liquor, and consists principally of chlorides of calcium, magnesium, sodium, and a little chloride of aluminum, with varying proportions of bromides of sodium and calcium. Tub No. 1 is filled every day with fresh brine, so that the process becomes continuous. The

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mother liquor, marking 30 to 38° Baumé, is evaporated to 45°, thus separating a new quantity of salt. The liquor is then decanted into stone stills; materials for the production of chlorine are added; and heat is applied in the form of steam, injected directly into the still, until all the bromine has been eliminated and vaporized. It then passes into a condenser, and thence into a receiver.

The production of bromine was first begun in the neighborhood of Parkersburg, Pennsylvania, by Hegeman, a Danish chemist, formerly in the employ of the Pennsylvania Salt Manufacturing Company. His operations were at first rather of an experimental character, and there being but little demand for the product at the time, he realized from $3.60 to $7 per pound for what he made. The use of bromides becoming more general, however, other chemists began the manufacture of bromine, their process differing from Hegeman's only in certain modifications of detail. Herman Lemer is now regarded as the largest producer of bromine in the United States. This manufacturer was originally a poor shoemaker of Natrona, Penn., but by a rare display of energy and ability, notwithstanding his limited education, he has reached his present position. The salt regions of Ohio and the Kanawha furnish salt whose mother waters are twice richer in bromine than those of any other salines as yet discovered. It is a remarkable fact that the mother waters of the saltworks at Syracuse and those of the West contain no bromine, or at least but mere traces of it. The annual production of bromine varies considerably, owing to uncertainties in the salt trade, upon which depends the bromine trade.

The capacity for the production of the article increased during 1875 and 1876 about three times what it was in 1874 (owing to facts just stated), but the actual production has not materially increased. The present production will reach about 1,100 pounds per day. In view of the high prices of bromides in the European markets, several lots have recently been exported. By reason of the great advantages that American manufacturers possess for the production of the bromides, it is believed that the importation of bromine, already quite limited, will soon cease altogether. The consumption of the article, in the form of the bromides, has considerably increased. During the last twelve years, bromide of potassium has been the principal salt used, but for the past three or four years, bromide of sodium, zinc, and several other bromides have become very popular. The only really new application of bromine is the use that has been made of it for some months past by a Paris house in the production of a new aniline color.

BAD WATER IN BALTIMORE.

A short time since Professor William P. Tonry reported to the Health Commissioner of Baltimore the results obtained by the analysis of seventy-one specimens of pump and spring water collected within the city limits. Of these samples 35 were from that part of the city lying to the east of the stream known as Jones' Falls, and 36 were from the west side. Of the former, 10 samples were filthy, 5 bad, 15 suspicious, and 5 good. Of the latter 23 were filthy, 5 bad, 7 suspicious, and but one that could be regarded as good.

The 23 worst samples from West Baltimore, and the 10 worst from East Baltimore, show such very large amounts of ammonia as to point unmistakably to direct and close contact with privy refuse, and it is more than probable that these wells or springs have been drawing part at least of their supply water from some of the privy wells which have been sunk to water. Of these 33 filthy samples 11 from West Baltimore and 4 from East Baltimore contained more free ammonia than a mixture of distilled water and urine, one-tenth of which was urine. Some individual specimens contained twice and three times this amount—enough, indeed, to indicate the presence of one-fourth urine in the samples. As to the bad and suspicious samples the source of contamination will be found in excrementary matter which has had to pass through the earth for a greater or less distance before oozing into the well.

The conclusions arrived at by Professor Tonry, by the study of these samples, are well worthy of consideration by the inhabitants of all towns drawing their water from numerous small and relatively shallow wells. Professor Tonry says that there is hardly any other conclusion to be arrived at than that privy wells cannot be sunk to water in the neighborhood of pumps without affording to the patrons of the pumps a liberal dilute solution of privy refuse for drinking water, nor can the surface of the ground in the neighborhood of the pumps be honeycombed by uncemented privy vaults without supplying the patrons of the adjoining pumps with a less liberal and partially filtered solution from the surrounding sinks.

Around New York there are doubtless many communities, small and large, whose ill repute for "malaria" is due in large part, if not entirely, to the circumstance that their water supply is largely drawn from contaminated wells and cisterns.

ENGLAND'S SOURCES OF MOTIVE POWER.

For a time so much popular apprehension existed among the English people regarding the exhaustion of their coal supply that a royal commission was appointed to inquire into the matter. They reported, after due examination into the subject, that the total available coal within the United Kingdom, was not likely to be exhausted under from 276 to 360 years, at the rate of consumption going on in 1871. Notwithstanding this long period before the coal supply will be exhausted, a writer in *L'Ingénieur Universal* thinks it is worth while for England to be inquiring now what substitute can be drawn upon for coal. For purposes of iron smelting there is no good substitute known except charcoal, and obviously its employment is out of the question in England. Therefore the writer concludes that there is very little prospect at present of inventive ingenuity doing much to supersede the use of coal in this direction. But for many mechanical and useful purposes a substitute would not be difficult to find. The writer thinks it has been demonstrated that coal gas for illuminating puposes can be superseded with advantage, and it is obvious that mechanical genius may any day work similar marvels in other departments where coal has hitherto been considered a necessity. There is no present prospect of such a result occurring in iron smelting; but for mechanical purposes increased attention is now being directed to hydraulic power—a power which has been too much neglected in our times of abundant coal supplies. He then repeats Dr. Siemens' calculations of the power that is daily running to waste at the Falls of Niagara, where 100 million tons of water fall some 300 feet every hour. The force represented by the principal fall alone amounts to 16,800,000 horse power; and to produce the same amount of power by steam would require 266 million tons of coal per annum—an amount which all the coal raised in the world would scarcely be sufficient to supply. Tremendous as this appears, the calculation may be regarded as more curious than useful; for, as the district around Niagara is destitute of minerals, the water power of the Falls is never likely to be utilized. But the calculation might be usefully applied to other places. Sir William Armstrong has done good service in the way of showing how to carry and utilize water power at a distance by conveying it through high pressure mains. For instance, were this power generally employed, where possible, to give motion to dynamo-electrical machines, the electric light could not only be produced altogether without the use of coal, but it could be carried to a great distance, illuminating towns distant from coal fields at less cost and in a superior manner to anything that has ever been done by gas. Another means that is capable of more extensive application is compressed air, which has been employed with wonderful results in some places on the Continent. Still, when all these and other sources of power are brought into more extensive requisition, coal will continue to be indispensable for many purposes. But though our stock in store is immense, the coal trade in the future is likely to experience greater vicissitudes than in the past; and, with the recollection of the fluctuations of the last ten years still fresh in the public memory, it is well as far as it is possible to provide a second string to our bow, so that when one source of power fails another may be readily available.

COLD CLIMATES IN THE TREATMENT OF CONSUMPTION.

No subject perhaps has received a greater share of attention from the medical profession than that of the proper method of treating consumption; and a more important subject has never enlisted the consideration of scientific men; for, of all the diseases with which mankind is afflicted, tuberculous consumption is perhaps the most serious, and, excluding epidemics, causes the greatest proportion of deaths. Indeed, statistics show that of the 968,000,000 people inhabiting the globe, 3,000,000 die each year of this dread disease. In view of this fact, Dr. Talbot Jones has prepared and published in the current number of the *New York Medical Journal*, an elaborate paper to show that, of all the resources at our command in warding off this malady where a predisposition to it exists, or in combating it when once established, dependence alone can be placed on climate. When we begin to inquire into the character and comparative merits of climates, he remarks, we are at once struck with the fallacy of the doctrine, which has obtained for generations, that the disease is more frequent in cold than in warm latitudes. Just the reverse of this is true. If there is anything with reference to climate which is definitely settled, it is the fact that phthisis is vastly more common in warm, tropical countries than in cold latitudes. Consumption is relatively as common in our own health resorts as it is in the corresponding warm countries in Europe.

From an extensive series of data, it has been shown that the farther we progress north the greater the immunity the inhabitants enjoy from the disease; and very far north, consumption is either extremely rare or altogether unknown. In the bleakest, coldest, and most exposed portions of the globe, and where sudden and severe changes of the atmosphere hold to a maximum, consumption is very infrequent. Indeed, so true is this that we are forced to the conclusion that extreme cold is inimical to the production of consumption. The primary effect of a cold climate is an increased demand for oxygen; tissue changes take place more rapidly, together with the products of increased tissue metamorphosis. To meet this increased demand on the economy, more food is taken, the digestive power and appetite are increased, and all the processes which govern organic nutrition are improved. The processes of absorption, secretion, sanguification, assimilation, respiration, and circulation, are carried on much more actively than in warm climates. Cold, whether it be water or climatic, is well known to be a powerful tonic. That increased oxidation of the tissues takes place in a cold climate is shown by the increased carbonic acid which is thrown off from the lungs. The most robust health is maintained where constructive and destructive metamorphosis of tissue is most actively carried on, and it is the fair balance of this process of destruction and reparation which constitutes the phenomena of life. The effects of heat on the system are much the opposite of those of cold. Heat is relaxing and enervating. Oxidation of the tissues is greatly lessened when the body is in an atmosphere warmer than itself. The effect of humidity combined with heat is not only immediately harmful and dangerous, but is very likely even to give rise to the tuberculous cachexy through suppression of cutaneous transpiration.

Out of a vast accumulation of facts with regard to climate, there are some upon which the profession are agreed. Among these is that of altitude. Careful investigation of this matter made by competent and trustworthy men, both in this country and in Europe, clearly indicates the importance of altitude in the climatic treatment of consumption. There is much more ozone in the higher than in the lower strata of the atmosphere, and that this is exceedingly valuable in the climatic treatment of phthisis is clearly indicated. Ozone possesses high oxidizing power and purifies the atmosphere by chemically uniting with the products of decomposition. It destroys organisms by combining with them. It also promotes nutrition and blood changes by supplying to the respiratory organs a most active form of oxygen.

A careful study of the facts adduced in his paper leads Dr. Jones to the following conclusions: (1.) No zone enjoys entire immunity from pulmonary consumption. (2.) The popular belief that phthisis is common in cold climates is fallacious; and the idea, now so prevalent, that phthisis is rare in warm climates is as untrue as it is dangerous. (3.) The disease causes a larger proportion of deaths on the seashore—the mortality diminishing with elevation up to a certain point. (4.) Altitude is inimical to the development of consumption, owing chiefly to the greater purity of the atmosphere in elevated situations, its freedom from organic matter, and its richness in ozone. (5.) Moisture arising from a clay soil or due to evaporation is one of the most influential factors in its production. (6.) Dampness of the atmosphere, from whatever cause or in any altitude, predisposes to the development of the disease, and is hurtful to those already attacked. (7.) Dryness is a quality of the atmosphere of decided value. (8.) The most unfavorable climate possible for a consumptive is one of uniform high temperature and of high dew point (warm and moist). (9.) The effects due to change in the atmosphere are by no means so pernicious as are generally supposed, and upon this subject present views require modification.

In conclusion, Dr. Jones adverts to the influence exerted upon consumptives by the climate of Minnesota; and, after pointing out the various facts relating to its geographical position, altitude, geology, character and configuration of its soil, and other physical aspects, gives it as his conviction that those predisposed to the disease, or laboring under its first stages, are likely to be benefited or cured by a residence in that State. Between the pleasant rolling prairie, the wooded lake region, and the dense pine forests of the northern section of the State, they can choose what seems most agreeable and best adapted to them; while the dry, bracing atmosphere will enable them to live much of the time out of doors without fear of taking cold, the latter feature being one of the greatest charms of the climate. The author strongly insists, however, on the inutility of sending phthisical patients to Minnesota who are in the advanced stages of the disease. Where the stage of ulceration and excavation has been reached, this climate does positive harm, although there are numerous exceptions to this rule.

Running a Locomotive Without Fire, Water, or Steam.—An Amusing Incident in the Career of Mr. A. L. Holley.

While working as an engineer on one of the railways he made a wager with some of his fellows that he could run a locomotive a mile without fire, water, or steam, the locomotive to be taken empty and cold from the shop, and towed by another engine to a point at some distance on the road, where a level stretch of track favored the experiment. Young Holley rode in solitary state on his cold locomotive to the scene of trial, and, unsuspected by his escort, so arranged matters that during the trip the motion of the drivers and pistons stored the boilers with compressed air. This gave him, by the time the destined point was reached, an accumulation of power by means of which he ran his mile and won his wager.

Underground Tides.

Our recent notice of the regular tidal rise and fall in the waters of certain South Carolina wells has called out reports of similar phenomena elsewhere. A correspondent in Vienna informs us that the water in the coal mines at Teplitz, Bohemia, exhibits similar tides. Something of the same nature has been observed lately in this city in digging for a foundation for the elevated railroad pier at 102d street and Third avenue, just below the old Bull's Head Hotel.

California Quicksilver.

Five counties in California contain quicksilver mines. During the past three years the aggregate production has been, in flasks: Napa county, Redington mine, 25,494; Lake county, Sulphur Banks, 30,849; Great Western mine, 14,266; Sonona county, Oakland, 4,687; Fresno county, New Ida, 17,846; Santa Clara county, Guadaloupe, 18,952; New Almada, 56,488. A flask of quicksilver contains 76½ lb.

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EDISON'S ELECTRICAL GENERATOR

When Mr. Edison said he was about to produce a practical economical electric light for general use, the entire business world took it for granted that it was forthcoming. Gas stocks tumbled both in this country and in Europe, and the people waited for the coming light. Scientists having had experience in this direction shook their heads, but for the most part suspended judgment.

Delay on the part of Mr. Edison comforted the holders of gas stocks, and confirmed the scientists in their belief that he had undertaken not only a task of great magnitude and difficulty, but one that would require more time and means than could be controlled by most experimenters. But Mr. Edison, flushed by his scientific victories, was undaunted and determined to yield to no obstacles.

Unfortunately, however, the daily papers from time to time printed reports of progress in electric lighting, which, from their extravagance and inaccuracy, placed Mr. Edison, to say the least, in an extremely embarrassing position as regards his alleged promises and the expected fulfillment of them, besides misleading the public as to the true nature of the problem to be dealt with, resulting in a reaction of feeling prejudicial to Mr. Edison's just fame.

At present little is said by Mr. Edison concerning his electric light, excepting that he considers it an assured success, and that he is perfecting the details of his electric lighting system as rapidly as possible.

It is not our purpose just now to enter into a description of Mr. Edison's electric lighting system as a whole, but to describe his new electric generator—one of the most important factors of the system—and also to describe his new electrical motor used in driving light machinery for domestic and industrial purposes.

The new generator resembles in some respects other well known forms, but it differs from them all in several very important particulars; for instance, the field magnets are immense, being about 54 inches high, and weighing about 1100 lb. The magnet cores—of wrought iron—are 6 inches in diameter, and 36 inches long; they are mounted upon heavy cast iron blocks, 10¾ inches high and 9 inches wide, and are connected at the top by a wrought iron yoke, 6 inches high and 7 inches wide. The cores are wound with 3 layers of No. 10 cotton covered wire, the ends of which are connected with binding posts on the base of the machine. The two blocks upon which the cores rest, as well as the bearings of the armature, are supported by a cross-shaped brass casting.

The armature which revolves in the cylindrical space between the poles of the field magnet is shown in section in Fig 2. It consists of a wooden cylinder, A, mounted on a 1½ inch shaft, and having attached to its ends soft iron plates, B, between which there are several layers, D, of No. 20 soft iron wire wound circumferentially. Outside of the iron disks, B, there are vulcanized-fiber disks, C, having their peripheries notched to receive the several coils, E, of insulated wire wound lengthwise on the cylinder and connected with copper bars, F, of the commutator cylinder, G. There are 41 $\frac{48}{1000}$ in. wires in each strand, and each strand passes lengthwise around the cylinder on diametrically opposite sides, the opposite ends of all of the wires in each strand being soldered to commutator bars on opposite sides of the commutator cylinder. There are 40 strands surrounding the armature, and the commutator cylinder is pressed on opposite sides by copper wire brushes which take off the current. The armature shaft has a 10 inch pulley with a 5 inch face, and the speed of the machine is about 500 turns per minute. Although the current from the armature may be used to excite the field magnet, Mr. Edison finds it more economical to charge the field magnet by means of a separate machine. In fact, he intends to charge a battery of such generators with a single Faradic machine of this form.

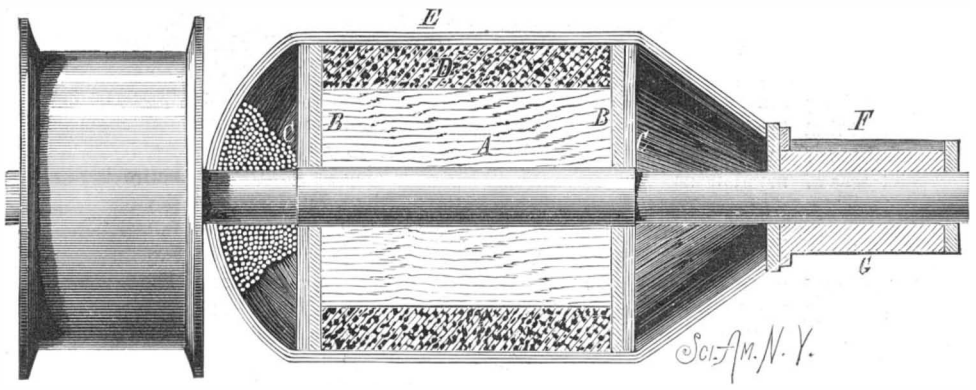

FIG. 2.—THE ARMATURE.

An important fact has been developed in the course of Mr. Edison's experiments with this generator. He finds that by connecting the ends of the field magnet by a copper wire for a moment when the machine is started, the field magnet soon attains its maximum charge, which it retains so long as the generator is in continuous operation. It requires a minute or more to fully charge the immense magnets, and when charged their influence is far reaching and powerful. The internal resistance of the armature is only ½ ohm, and Mr. Edison claims that he realizes 90 per cent of the power applied to this machine in effective external current. It requires but 0 horse power to drive it, and the current generated is sufficient to produce lights of sixteen candles each. The economy of this machine is shown by the fact that one man may turn it with sufficient rapidity to maintain the electric arc of a Jablochkoff candle.

While this generator in general principle is the same as in the best of the well known forms, still there is an all-important difference, which is, that it will convert and deliver for useful work nearly double the foot-pounds of energy that any other machine will under like conditions. It has been shown by Hopkinson that the Siemens machine, which is generally recognized as the best form yet devised, converts from the belt to the circuit 92 per cent of the energy, but later corrections reduce this to 83 per cent; from these results many scientists have inferred and stated that there was little margin for improvement in the generating machine. Now the energy converted is distributed over the whole resistance; hence if the resistance of the machine be represented by 1, and the exterior circuit by 9, then of the total energy converted, $\frac{9}{10}$ will be useful, as it is outside of the machine, and $\frac{1}{10}$ lost in the resistance of the machine.

The Siemens machine, and nearly all other machines in use, make the external resistance equal to that of the machine; hence one half of the energy only is useful, and any attempt by these inventors to increase the exterior resistance, so as to change the distribution of energy to obtain more exterior work, results in reducing the power of the machine to convert energy. Therefore, efforts toward economy in one direction are met in the other direction by loss in the interest account due to the necessity of using a greater number of machines to convert a given amount of power.

In Mr. Edison's generator 5 horse power is transferred upon a resistance of 5 ohms, of which a ½ ohm is in the machine, thus delivering $\frac{9}{10}$ of the total current upon a circuit exterior to the machine; thus nearly the maximum economy is attained when other machines, under like conditions, will scarcely give any current at all.

In dealing with the electric light problem, Mr. Edison has very properly devoted a large share of time and attention to the production of an economical generator, as it is the very foundation of the system. It bears the same relation to electric lighting that the cheap production of gas does to gas lighting. It is as important to generate electricity cheaply as to use it economically. Mr. Edison meets squarely both ends of the question, and is carrying on his experiments on a gigantic scale; being encouraged by new developments he continues his researches in expectation of still better things. His electric generator he considers complete; his electric lamp, although in good usable form, is slowly improving, and will not be introduced to the public so long as Mr. Edison thinks it can be improved.

The lower view in our large engraving represents one end of the Menlo Park machine shop, showing the 80 horse power engine in the engine room beyond. One of the new electric generators is shown on the right, and the dynamometer with which the power tests are made is shown on the left. Not far from the generator is placed an electric dynamometer, shown in one of the smaller views at the top of the page.

This electrical dynamometer is the invention of Prof. J. W. Trowbridge. Mr. Edison has, however, improved it and adapted it to his own purposes. As there is neither iron nor magnets in the apparatus it may be used in the vicinity of the generator without being influenced by its magnets.

The electrical current traverses the two large spirals of copper ribbon, and also the smaller spiral, whose bifilar suspension keeps it at right angles to the larger spirals when no current passes. The smaller spiral carries a small mirror, and the readings are taken from a distant scale, the light spot serving as an index. The circuit is completed through the smaller spiral by means of mercury cups kept cool by water running through their hollow walls.

The galvanometer tests are made in a distant building where neither jars nor magnetic influence can affect the accuracy of the readings. The galvanometer (Thomson's reflecting) is placed on a table resting on a brick foundation and is inclosed by a dark chamber having apertures for viewing the scale. The development of the new electric generator has required months of careful investigation by aid of these two instruments, and it is only after making hundreds of alterations and experiments that the improvement has been wrought.

Fig. 3 shows Mr. Edison's new electric motor intended for running sewing machines, small elevators, lathes, and other light machinery, by connecting it with the same wires that furnishes the current for the electric lamps. Its construction differs but slightly from the electric generator. The armature is arranged parallel with the magnet instead of transversely, and the magnet is formed of a single casting. In other respects it is like the generator, having the same form of armature, also commutator cylinder and brushes. The engraving represents the motor about one fourth of its real size.

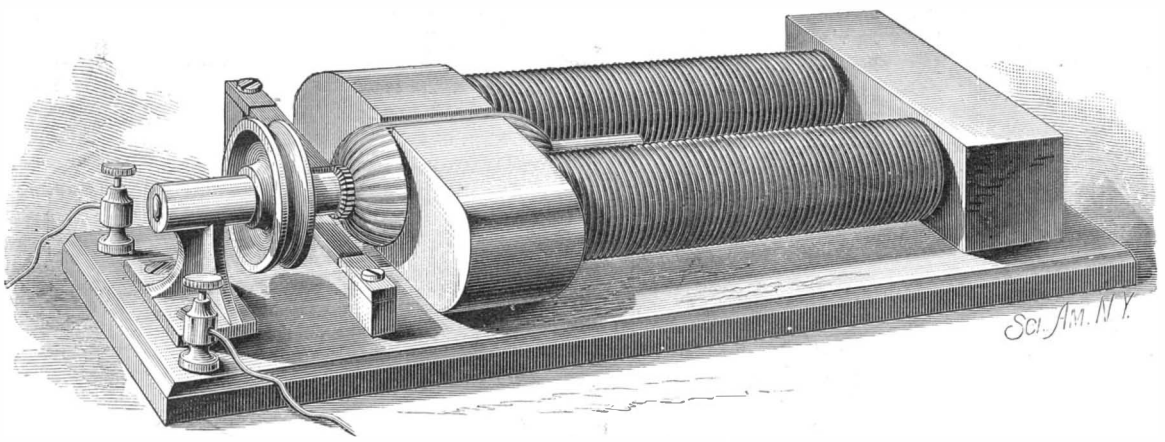

FIG. 3.—EDISON'S ELECTRIC MOTOR.

Whatever may be said or thought in regard to Mr. Edison's progress in electric lighting, it cannot be denied that he has made important discoveries which must tend to cheapen the electric light generally, and when he shall have completed his electric lighting system we hope he will reap the reward merited by his untiring perseverance.

MECHANICAL INVENTIONS.

An improvement in counter stiffeners for boots and shoes has been patented by Mr. Frank Avery, of Garden Prairie, Ill. The object of this invention is to provide a counter stiffener that will be durable, stiff, and waterproof, and that can be easily applied in the manufacture of all kinds of boots and shoes.

Mr. John W. King, of Huntingdon, Tenn., has invented an improvement in washing machines. The invention consists in a simple arrangement of mechanism for driving pounders or cups.

Mr. Lyman H. Blend, of Oneonta, N. Y., has patented an improved machine for use in the treatment of paralysis in its various forms, curvature of the spine, and their kindred diseases, by producing a passive motion of the feet and legs similar to the natural step in walking, and by the partial suspension of the body from the waist or head.

Mr. Jacob Obrist, of Au Sable Forks, N. Y., has patented an implement for holding and entering tacks in putting down carpets, trimming and covering furniture, and other similar purposes. It consists in providing the lower jaw of the pinchers with a V-shaped notch to receive the shank of the tack, while the upper jaw bears upon the head and holds it securely while being entered; also, in curving the handles, so as to permit the lower jaw to rest upon the floor and leave space for the hand under the handle.

An improvement in detachable table legs has been patented by Mr. James W. Bullock, of Boston, Mass. The object of this invention is to construct tables, stands, chairs, and other articles of furniture, so that they can be readily taken apart and packed in compact form for transportation; and the invention consists in the attachment of the legs by dovetail joints and spring friction devices, so that they can be easily removed and adjusted.

Mr. Eli Hancox, of Troy, N. Y., has patented a lap ring for chains of all kinds. It consists of diagonally overlapping and interlocking ring sections, that are connected by a central transverse stay, secured by a fastening screw, and, in addition thereto, by cross pins or rivets.

A device for sawing logs into boards or joists, etc., of any desired thickness and width at one and the same time at one operation, has been patented by Mr. John W. Morris, of Moss Point, Miss.

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FRENCH HORIZONTAL FLOUR MILLS.

The mills exhibited at the late Exhibition in Paris by Messrs. Bresson, Fanchon & Co., of Orleans, are novel in several particulars. The stones are arranged so that they lie parallel to each other, and they are arranged so that they may yield when subjected to sudden jars or shocks. This avoids serious damage to the mill, and prevents the heating of the stones and grain. The grain is drawn in through the eye of the stone, and equally distributed between the stones by an apparatus which also furnishes cool air for the spaces between the stones, which cools both the stones and the grain. A cast iron case incloses the stones, leaving an air space all around them, in which air currents are produced by a blower at the top of the casing. These mills are provided with conveniences for removing and replacing the stones, and they are compact and efficient.

The stationary mills shown in Fig. 1 are supported by a strong cast iron frame, and the portable mills, Fig. 2, are supported by a substantial wagon frame. The bolting box is connected with the mill and has no special shafting, but takes its power directly from the shaft that drives the stones.

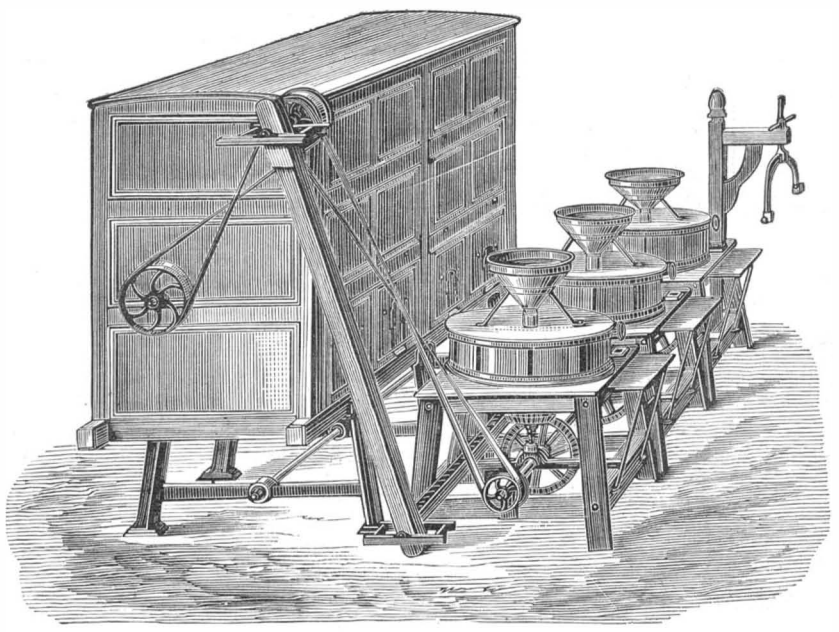


FIG. 1.—STATIONARY MILL.

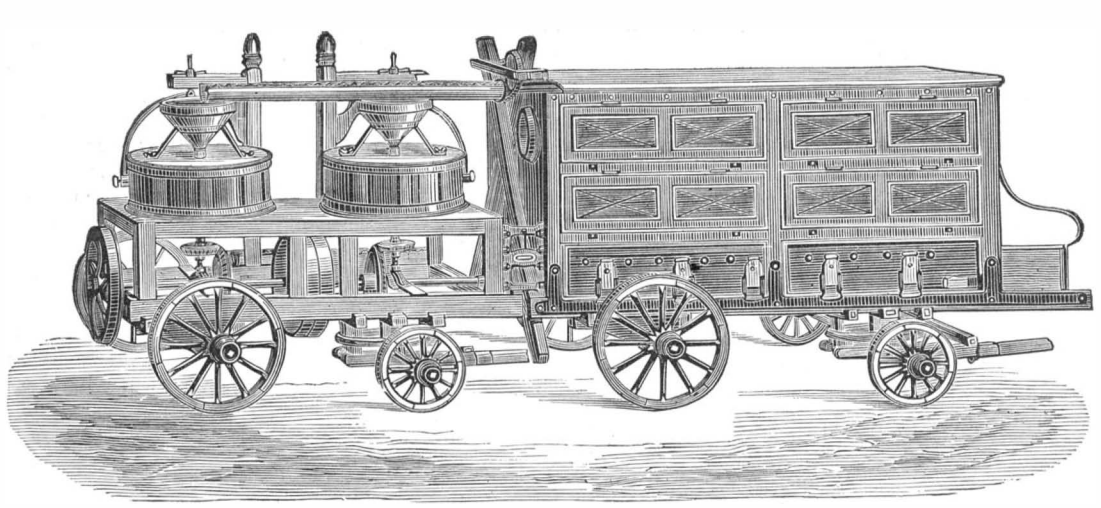


FIG. 2.—PORTABLE MILL.

Wood Pulp Making.

According to *Leffel's News* Newton's pulp mill, at Holyoke, Mass., uses five cords per day of spruce and poplar wood in the making of manila papers. In wood-paper manufacture the split fourfoot timber is fed into a circular fan-like hopper provided with swiftly revolving steel knives, which cut the timber into small chips in very short order, when a fan drives them up into the loft, where they are shoveled into two steel digesters holding from four to six tons each. Soda ash and other chemicals are introduced, a heavy head of steam is turned on, varying in different mills from 100 to 200 lb. pressure to the square inch, and the chips are cooked until the fibers are thoroughly separated. Then the pulpy mass is washed out into vats to drain off the chemicals, and after it has become solid it is again washed out and pumped up into the engines and beaten, and the usual process of paper making is then gone through with.

Some makers, like Superintendent Tower, formerly of the Dexter Company, of Windsor Locks, think evergreen woods far preferable, as having a larger and more hardy fiber. He thinks we are only in the rudiments yet of wood-paper making, just as the rag-paper men were twenty years ago, and believes the time is coming when, by gradually discovered processes, wood papers may be as finely made as rag papers are now.

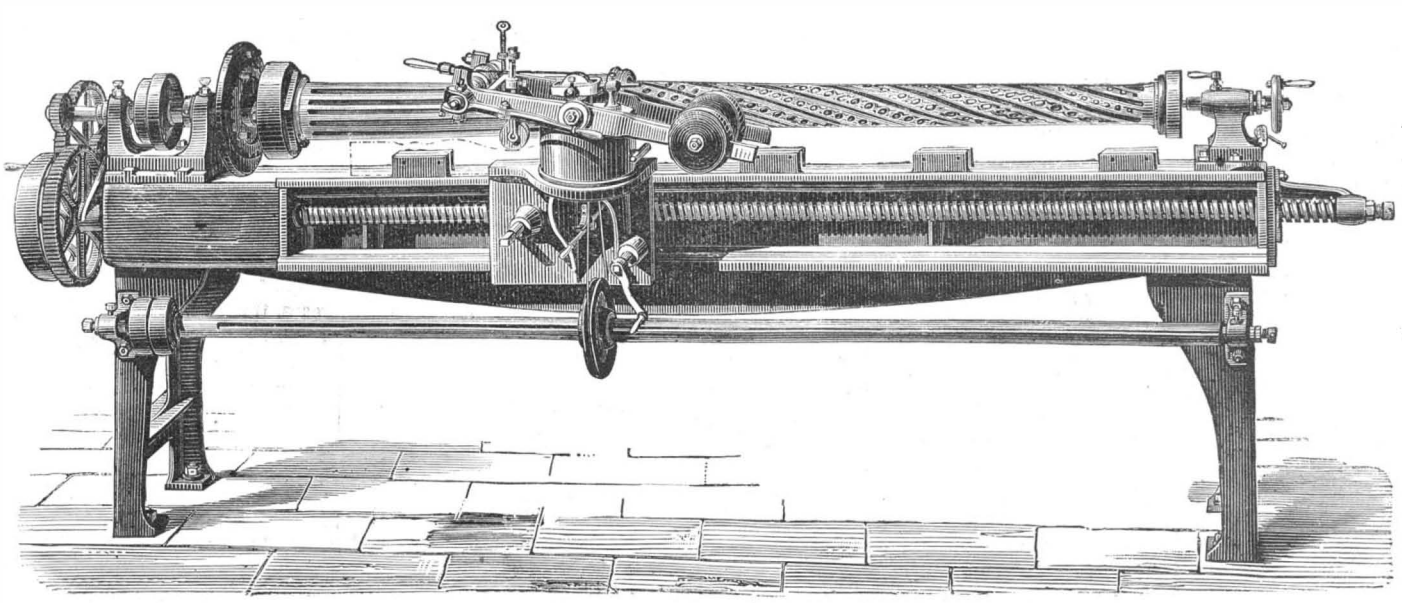
Quick Forging.

Recently the steamer St. John, of the People's Line to Albany, broke her shaft. A new shaft, 37 feet 6 inches in length, 20 inches average diameter, and weighing 40,000 lb., was made from the blooms, turned, and finished in six days. The work was done at John Roach's establishment, and is pronounced the quickest work of the kind ever done in this city.

CARVING ATTACHMENT FOR LATHES.

The carving attachment shown in the engraving is from the shops of M. Arbey, of Paris, France. It is intended to be affixed to common lathes for the purpose of grooving, channeling, and ornamenting columns balusters, table legs, and similar articles of irregular shape The carving attachment is placed on a traveling carriage, and supported on an adjustable cylindrical standard, to which the balanced arms of the cutter shaft are pivoted, the latter being revolved by a pulley and belt connection with a traveling pulley of the cutter-actuating shaft. The cutter shaft is movable on its bearings by a lever handle, while the pulley is retained by a clutch connection with a fixed brace of the weighted arms, and it is raised or lowered by means of a curved arm and guide roller passing along the pattern of the form. When a table leg or other object is held in position of rest in the lathe, the cutting tool passes longitudinally along the same, and works out in it a groove or channel. The dividing disk being turned for the distance of one subdivision after each channel is completed, the next channel is then produced by the return motion of the carriage. By turning the object slowly in the lathe, simultaneously with the revolving and traversing motion of the cutter, helicoidal channels or grooves are formed. For grooving conical parts, the cutter shaft is guided along an inclined guide pattern, or its axis is placed at an angle to the longitudinal axis of the lathe. The cutter adjusts itself to the shape of the object, and carves, by its uniform forward motion, an ornamental groove of equal depth throughout the entire length. For the purpose of pearling or doing other ornamental carving, the cutting tool is guided to the work by a handle, while the object is turned in the regular manner by the dividing disk, so that the pearls may be formed at uniform distances.

The adjustability of the cylindrical standard, in connection with the balanced cutter shaft and handles, admits of the convenient and accurate handling of the carving attachment, so that a large variety of ornamental work may be accomplished on this machine quickly and economically.



ARBEY'S CARVING ATTACHMENT FOR LATHES.

MISCELLANEOUS INVENTIONS.

Mr. Richard R. Jones, of Remsen, N. Y., has invented a simple and economical arrangement for fastening the covers of butter tubs, so as to make them perfectly secure and airtight. It consists of crossbars applied to the top or cover at right angles to each other, the ends of which are adapted to enter under the flanges of ears projecting above the top of the tub, and thus fasten the cover securely in place; it also consists of a key for preventing the cover from becoming disconnected from the ears, and which also serves, when drawn out, as a lever for turning the cross pieces under or out from the ears, as may be required.

An improvement in bricks has been patented by Mr. Effingham L. Schieffelin, of East Chester, N. Y. The object of this invention is to provide bricks to be used in the inner walls and partitions of houses as a substitute for laths in holding plaster, stucco, etc., the bricks having rows of grooves or indentations sunk on a downward incline in one face, into which the plaster or stucco will enter and be held fast.

Mr. Emil Hunziker, of South Bergen, N. J., has invented an improved safety faucet holder. The object of this invention is to provide a method of tapping barrels of beer and other liquid, and entering a faucet therein without permitting the escape either of gases or liquids therefrom.

Mr. James P. Crutcher, of Bethesda, Tenn., has patented an improved horse detacher for disconnecting the traces from the singletree, and thus allowing the horse to free himself from the vehicle in case of accident or danger requiring it. The traces are secured to the singletree by sliding spring bolts, which are held in a retracted position out of engagement with the traces by means of spring catches.

An improvement in concrete pavements, patented by Mr. John Murphy, of Columbus, Ohio, relates to pavements having a base of cobble stone; and it consists in combining with the cobble stone, for filling up the interstices and giving a smooth upper surface, a mastic composed of pulverized iron slag, pulverized stone, dried sand, oxide of iron, lime, and pitch or asphaltum and coal tar.

Mr. William Beeson, of Eagle Rock, Idaho T., has patented an improved automatic table waiter to take the place of the waiters in restaurants, saloons, and other places for carrying the orders from the tables to the cook room or counter, and the articles ordered back to the tables.

An improvement in linchpin holders, patented by Mr. Benjamin Goodyear, of Carlisle, Pa., is designed to prevent the misplacement of the linchpins of wagons and other vehicles, and it consists in a band or ring attached by a hinged joint to the hub, so as to encircle the spindle and cover the ends of the linchpin. The holding ring can be raised for relieving the pin when desired, and when in place, for further security, is held by a spring catch.

Mr. Constantin Lazarevitch, of Brooklyn, N. Y., has patented an improvement in devices for preventing the shifting of grain in vessels. Vessels carrying grain in bulk have their holds provided with a ceiling or lining to keep the grain dry, and having, running lengthwise through the center of the hold, partitions called "shifting boards," which divide the cargo into two portions, for the better protection of the vessel; yet these boards do not always prevent the grain from shifting, so that the vessel may be thrown on her beam ends. This invention consists in arranging on each side of the hold of a vessel, and securing to the cross and deck beams, a series of triangular box frames, with bases uppermost, closed at the ends with strong partitions, and reaching from the deck above to supporting joists or timbers below, and in hinging to the upper longitudinal pieces of each

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frame two broad tables of wood or metal corresponding in length and width with the sections, so arranged that one will overlap the other at whatever angle they may be inclined; each end partition is provided with two pawls, which engage on the uppermost table, and serve to hold both of them down.

An improvement in breast collars for harness has been patented by Messrs. R. Pattin, of Harmar, H. L. Sibley, of Marietta, and T. M. Beagle, of Harmar, Ohio. This improved device is constructed of a rod or stout wire bent into the required shape, thus forming a skeleton arch, to which a bridge plate is attached at the center, and is applied to a breast collar by a rivet, so that its ends are free and cushioned on the latter.

Mr. Herman T. Detert, of Faribault, Minn., has patented an improved pad for horse collars, which is so constructed as not to rest upon the top of the horse's neck, thus preventing the neck from being made sore, and allowing it to heal if previously injured. The invention consists in the angular iron plate having the front and rear parts of its middle or angular part cut away.

An improved washboard has been patented by Mr. Franklin M. Smith, of Thivener P. O., Ohio. The invention consists in a novel construction of the frame of the washboard, and of bars used in connection therewith, to form a rubbing surface for the clothes, whereby provision is made for placing the bars in position, and for removing them and changing their positions when they become worn.

Mr. Benjamin P. Morrison, of Abingdon, Va., has patented an improved fence post, which may be readily set in the ground without its being necessary to dig a post hole, and which, when set, will support the fence firmly.

Messrs. John McL. Wood and William N. Bellah, of Saint Jo, Texas, have patented an improved iron saddletree fork, consisting in a combination of plates made with a curve or swell, and provided with the plain flanges and the notched flanges, with the arms of the fork having their inner sides recessed and provided with the plain flanges and the notched flanges.

An improvement in lamp stove ovens has been patented by Mr. Charles W. Daly, of Brooklyn, N. Y. This invention relates mainly to the construction of cooking ovens for lamp and gas stoves, steam heaters for cooked food, and other similar apparatus, the object being to render them simpler and less expensive in construction than when made in the usual way.

An improved drill sharpener has been patented by Mr. Thomas J. Williamson, of Carson City, Nev. The drill to be sharpened is heated, and then the end or point placed between dies in the recess that corresponds to the diameter of the drill, and the blocks and dies closed upon the drill point; then, by striking a few blows with a hammer on the drill head, the point is spread and caused to take the shape of the recess and the edge sharpened.

An improvement in feeding apparatus for nail machines has been patented by Mr. John T. Jones, of Chattanooga, Tenn. This device insures a definite vibration of the feeding devices, so that the nail plate or rod is fed a uniform distance, thereby preventing making the nails too large. It also adjusts the throw or vibration of the forks, and thereby regulates the feed as required for nails of different sizes.

Export Paper Trade.

A contemporary notes, as an important feature of the paper industry, the steady increase in the exports of American paper, especially of the finer kinds. The total exports last year amounted in value to $1,108,318, having grown from the comparatively insignificant amount of $3,777 in 1869. The imports, on the other hand, have dwindled down from the maximum of $1,326,460, in 1873, to the total amount of $135,487 for papers of all kinds last year. These latter were largely made up of wall papers of the more expensive designs, only a trifling quantity being fine writing papers. The superiority of the home-made paper is now fully conceded at home as well as abroad, and large orders have lately been received from new customers in Holland and other countries. Recently there were representative buyers here from Japan and China, who have hitherto been accustomed to have their wants supplied in the British markets. The qualities for which the fine domestic papers are noted are their purity, tenacity, freedom from blemish, and beauty of finish. The machinery used is brought to the greatest degree of perfection, and new improvements are constantly being made.

Home Chemicals.

Among the articles of merchandise formerly imported in large quantities, but which have been largely superseded by home production, are chemicals. Tartaric acid, the importation of which last year reached only 183 lb.; not long ago 500,000 lb. came from abroad annually. Of citric acid, 27,018 lb. was imported, against a previous annual importation of 250,000. The lime juice, from which the acid is made, is still imported on account of the small growth of limes and lemons in the United States. If Southern agriculturists, suggests a contemporary, gave attention to these fruits, a new industry, in extracting the juice, could be developed. Last year but 3,492 lb. of borax was imported, owing to the working of our new borax mines. Formerly from 600,000 to 1,000,000 lb. was annually received. Of cream tartar, none was received in 1878 from abroad. About six years ago the receipts were 9,000,000 lb. annually.

TORTOISE SHELL

The horn-like epidermoid plates which cover the dorsal buckler or carapace of the sea tortoise, are in some species so fine and of such beautiful colors as to be employed for various purposes of art. It is only those, however, of the hawk bill (*Eretmochelys imbricata*) and caret species that possess any great trade value, the plates being stronger, thicker, and clearer than in other species. There are usually thirteen plates on the carapace, called collectively in trade, 'the head"—four on each side and five on the back, the last bent in the center. Of the side plates, the two middle are the most valuable, being the largest and thickest, those on the back and margin, known as the "hoofs' or 'claws," are comparatively of less value. There are twenty four marginal pieces, which are termed the 'feet' or "noses." The *lamellæ* or plates vary in thickness from ⅛ to ¼ of an inch, according to the age and size of the animal, and weigh collectively from 4 to 6 pounds or upward. In an animal of ordinary size, about 3 feet long and 2½ feet wide, the largest plates weigh about 9 ounces and measure about 13 by 8 inches, and are ¼ of an inch thick in the middle.

Tortoise shell is usually detached from the carapace and bony framework by placing heat below, or sometimes by soaking it in boiling water. In the West Indies the plates or blades of tortoise shell are removed by burying the carapace in the ground or sand for ten or twelve days. When taken up the blades fall off, and the thirteen dorsal pieces are easily collected. A small hole is bored in each, so as to string them together, for no experienced buyer will purchase a case of tortoise shell unless the whole of the shell is thus presented. The "feet" or "noses" of the tortoise shell are chiefly in demand in China.

The blades of the hawk bill or imbricated turtle are very transparent, and more beautifully mottled than those of the caret turtle; the scales of the latter are thinner, and are not used for the same purposes, but employed for veneering and inlaying work. The shell of the hawk bill has a blackish-green color, with yellowish spots, while the color of the plates of the caret turtle is blackish, with irregular transparent spots of golden yellow and veined with red and white, or of a brownish-black of various shades. The plates of the green or edible turtle (*Chelonia mydas*) are thin and flexible, and of slight manufacturing use. The scales of the loggerhead turtle (*Thalassochelys caouana*) are of a dark chestnut brown, very thin, and neither clear nor beautifully colored, hence they are of little value; but latterly some use appears to be made of them, for the English imports of turtle shell (as it is named in contradistinction to tortoise shell) have averaged in the last four or five years $30,000 in value.

Tortoise shell is worked upon like horn, and is usually softened or rendered plastic by placing in boiling water containing a handful of salt to the quart; by this means it is rendered so soft that it can be pressed into moulds. The moulds employed are double, so as to contain the shell between them. When all is ready the mould is put into a press, and the upper half gently pressed down upon the shell The whole is then put into boiling water, and as the shell becomes more and more softened the upper half of the mould is from time to time screwed down, until at length the shell is completely pressed into the lower mould, so that any devices that may have been engraved or embossed upon the two halves of the mould leave corresponding impressions upon the shell. When two pieces of tortoise shell are to be joined together the two edges are beveled off, so that one inclined edge may lie on the other. The edges are then scraped perfectly clean, contact with the fingers or any greasy substance being carefully guarded against. A piece of paper is then bound around the overlapped edges and fastened with a string. A pair of tongs or pincers are then heated and applied to the shell, one jaw above and the other beneath, by which the shell is grasped throughout the length of the seam or overlap. By holding it for some time in this position the heat of the iron softens the shell and causes the two pieces to unite or weld firmly. For modern uses thick tortoise shell is more valuable than thin. The uses of the article for ornament are varied, and the number of articles made from it are very numerous. Brown and light colored shell is imported from India and China to France for fans, the former costing $6.25 per pound and the latter as much as $20. In China and Japan very beautiful cups and saucers and fancy boxes are made from this material.

Tortoise shell has always been a favorite material for combs, but it is only in recent years that jewelry made from it has become fashionable in Europe and America. England imports annually large quantities of tortoise shell, and, according to Mr. P. L. Simmonds, from whose "Commercial Products of the Sea" these notes are borrowed, maintains the monopoly of this artistic material. The material is received from India, China, the Eastern Archipelago and Pacific Islands, Australia, the West Indies, South America, and Africa.

The Last Bicycle Race.

The six days' bicycle race, which took place at Agricultural Hall, Islington, England, during the first week of September, resulted in a victory for the present champion long distance rider, Mr. Waller, of Newcastle-upon Tyne, who obtained the lead at mid-day of Monday, and held it until the close of the contest, winning the belt, valued at £100, and £125 in money. He totally eclipsed all his previous brilliant performances, being credited with the remarkable record of 1,404 miles 6 laps; Terront, a plucky French rider, secured second place, with a score of 1,390 miles 5 laps; Higham, third, 1,145 miles 3 laps, Cann, fourth, 1,100 miles 1 lap, several other participants making smaller scores The attendance was large and enthusiastic, especially on the last day, when 10,000 persons were present.

THE LOCALIZATION OF ARSENIC IN THE BRAIN.

The important discovery made a few years ago, says the *Lancet*, by MM. Gauthier and Scolosuboff, that arsenic administered to an animal becomes deposited in considerable quantities in the brain, has suggested to two French investigators, MM. Caillol and Livon, a further series of experiments for the purpose of ascertaining in what condition the arsenic is accumulated, whether as a simple deposit or as an organic compound. The cerebral substance contains two elements—phosphorus and nitrogen—with which arsenic has many common characters. The three bodies form similar compounds, and in many of these one element may be substituted for the other without affecting the general characters of the compound.

Phosphorus exists in the brain in the form of lethicine, it is supposed as a phosphoglyceric acid, combined with a base —neurine In the waste of the brain, lethicine probably breaks up, and phosphoric acid ultimately results and passes away by the urine. Arsenic may replace either nitrogen or phosphorus, and in the former case may form a compound analogous to neurine, in which the nitrogen is replaced by arsenic, and in the latter case the replaced phosphorus may be expected to be eliminated in undue quantity, combined with oxygen or in some organic compound. The first object of the experiments was to ascertain whether the elimination of phosphorus underwent any change during the administration of arsenic in small doses, which produced death in about a month. It was found that during the period of arsenical poisoning the quantity of phosphorus eliminated was considerably increased. It is inferred that this phosphorus must have been turned out of its compounds of the brain, but it may be thought that this conclusion is scarcely beyond criticism, for the excretion may be the result of a morbid state depending on the presence of deposited phosphorus.

CHLOROPHYL.

The green coloring matter of leaves has been recently reinvestigated by M. Frémy, and his results shed some light on the cause of the coloration of autumn leaves, although further study is still necessary to account for the manifold brilliant tints found in American autumnal foliage. M. Frémy's previous studies on chlorophyl tended to prove that it was not a simple coloring matter, but composed of two different substances—a yellow, which he named *Phylloxanthin*. and a bluish-green named *Phyllocyanic acid*. His more recent investigations have had for their object to ascertain in what condition these constituents of chlorophyl exist in the organic tissue, whether mixed or combined, suspended in the liquid, or united with the cellular tissue.

By means of experiments, which are given in detail in the *Journal de Pharmacie et de Chimie* (tom. xxvi., s. 5), but which it is unnecessary to quote here, he finds that they exist in the leaves as a mere mixture. It yet remained to ascertain whether the phyllocyanic acid existed in a free state, or combined with a base, or united with the cellular tissues by a sort of capillary affinity. Analysis showed the presence of a notable quantity of potassa. The green matter of leaves, then, can be considered as a phyllocyanate of potassa mixed with phylloxanthin.

"It has long been known," says M. Frémy, "that leaves in autumn lose their green appearance, changing to yellow, and also give off a large portion of their alkali. Now we know that this process depends upon the decomposition of the phyllocyanate of potassa."

A Successful Year.

The year 1879 will pass into American history as a year of wonderful agricultural prosperity. The cotton crop is larger by half a million bales than ever before, the tobacco crop 12,000,000 pounds greater; and the sugar crop exceeds by some 200,000 hogsheads all previous yields. These are crops which belong almost exclusively to the southern half of the republic. In behalf of the Northern States the excess of products this year over the crops of any previous year is, according to the Chicago *Journal of Commerce*, 20,000,000 bushels of wheat and from 80,000,000 to 100,000,000 bushels of corn. The hog crop also is larger this year than for a number of years past—if it be not the largest ever raised.

The Use of Spectacles Delayed.

Dr Cheatham recommends, in the *Louisville Medical News*, the use of sulphate of eserine as a means of delaying the use of spectacles, so that they will not be required for several years, this alkaloid having the power of stimulating the ciliary muscle and thus assisting accommodation. The strength of solution recommended is one grain of the sulphate of eserine to an ounce of water. One drop of this solution is to be put in the eye at night, or when required.

CURRENTS OF AMPÈRE.—Ampère asked if the molecular currents of magnets are entirely created in the magnetic substance during magnetization, or if the magnetizing cause merely determines a circulation of currents pre-existing in the metals in their natural state. He inclined to the latter opinion. The author thinks that there is every reason to admit, with Ampère, that the particular currents pre-exist in the magnetic metals, and that the current of the battery merely determines the circulation and the direction.—*M. Trève, in Comptes Rendus.*

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RECENT DECISIONS RELATING TO PATENTS, TRADE MARKS, ETC.

By the U. S. Circuit Court—Eastern District of Michigan.

PAVEMENT.—PHILLIPS *et al. vs.* THE CITY OF DETROIT.

1. The members of the Board of Public Works of Detroit are bound by an injunction against the city, of which they have notice, notwithstanding they are not parties to the suit nor the writ, and the same is not actually served upon them.

2. It is no excuse for the violation of a preliminary injunction in a patent case that the patent is invalid or the writ improvidently granted. If the court has jurisdiction to issue the writ it must be obeyed until it is dissolved.

3. The wooden pavement patented to Robert C. Phillips is infringed by the use of blocks cut from trees or saplings in their natural form, though a narrow segment is cut off from one side of each block.

4. Where a preliminary injunction in a patent case is violated the respondents will not be required to pay the patentee the amount of his royalty where they were acting in an official capacity, deriving no personal benefit from the infringement, especially if there be any reason to believe they acted in good faith.

By the U. S. Circuit Court.—District of Massachusetts.

SPINNING FRAME.—DRAPER *et al. vs.* WATTLES.

1. Nothing being claimed upon reissue (Reissue Patent No. 6,386, W. T. Carroll, April 20, 1875, spinning ring) but what could have been claimed in the original patent, the suggestion of "new matter" was not sustained.

2. The mere deposit of a model in the Patent Office gives rise to no inference that the application for patent was completed at such date.

3. Although the circumstances of the inventor and the nature of the article may have required that it be tested by others, still, under the defense of adverse public use, it is somewhat difficult for a court to qualify, by a supposed intention not declared at the time, the act of an inventor who sells the patented article on two occasions, apparently in the ordinary course of trade.

4. Section 7 of the patent act of March 3, 1839, as amendatory of that of July 4, 1836, construed to imply that the purchase, sale, or prior use of an invention, etc., in defeat of a patent, shall have been with knowledge and consent of the inventor.

5. But the sale, purchase, or use must have been of the thing patented. *Hence,* where it was a less perfect article, not merely a colorable variation, no dedication results, although such article may embody features in common with what was thereafter patented.

By the Commissioner of Patents.

EX PARTE SMITH.

1. The question whether a complete process, chemical or mechanical, can be subdivided in an application, and whether, when it is so subdivided, a claim for one of the subdivisions can be joined with a claim for the complete process, turns on the question whether such subdivisions constitute subprocesses, effecting themselves distinct results subsidiary to the general result of the entire process.

2. An applicant may join in one application a broad or generic claim for a method or process, and a specific claim for one of its forms or modifications; but he cannot unite such broad claim with specific claims for two or more of its modifications, nor can he unite in one application two such specific claims without the generic claim.

3. An applicant may join in one application a broad claim for a process of fixing colors, including, as elements, (1) painting the substance; (2) heating it; (3) subjecting it to the action of vapor; and (4) raising the temperature of the vapor during its application; and a claim for one specific form or modification of the process covered by the broad claim, including, for example, (1) painting the substance with corrosive colors; (2) heating it; (3) subjecting it to the action of vapor; and (4) raising the temperature of the vapor during its application.

4. Two claims, of which one does and the other does not show a gradual increase in the temperature of the vapor as an element of the process of fixing colors cannot sustain to each other the relation of process and sub-process, nor that of genus and species, and cannot coexist in one application.

NICHOLSON *vs.* BENNETT *et al.*

1. Interferences between patents cannot be adjudicated in the Patent Office; but interferences between one or more applications and two or more patents can be adjudicated in the Patent Office, and priority awarded to one of the patents or to an application according to the facts, and such adjudication is binding upon all parties so far as the interference in the Office is concerned, although not conclusive as to the relative rights of the parties outside of the Office, nor even in *ex parte* proceedings in the Office.

2. It is the fact and not the possibility of the claim of an invention by an applicant which legalizes the declaration of interference between his application and other applications or patents showing but not claiming the device.

3. Subjects of interference are things, not words; and the same words must mean the same things in their application to several devices in interference. The issue cannot have one meaning when applied to one and a different meaning when applied to the other.

4. The word "deflecting" is accurately applied to the two inclined planes which constitute the upper walls of the combustion chamber in Arbogast's patent No. 180,517, dated August 1, 1876; but it has not the same meaning when so applied which it has when applied to the upper walls of the combustion chamber in Nicholson's application, filed May 28, 1877, and in Arbogast's patent No. 188,328, dated March 13, 1877. On this point the application and patent of 1877 are not anticipated by the patent of 1876.

By the Acting Commissioner of Patents.

EX PARTE LIPPINCOTT.

1. The same requirements as to the division of an application apply to reissue as to original applications.

2. Giving to the words "revision" and "restriction," occurring in section 4,916 Revised Statutes, their ordinary signification, they cover all actions which the Patent Office is authorized to take in regard to any application for a patent, and therefore extend to the office the same control in all respects over reissue applications that it has over original ones.

3. A single composition needs but a single claim, and if an applicant regards a second claim necessary to protect him in the employment of added ingredients, such claim must be regarded as embracing another and a different article, and a division of the application required.

Correspondence.

Manufacture of Paper Collar Goods.

To the Editor of the Scientific American:

My attention having been called to an item in your paper of September 6, copied from the *Science News* (evidently an English paper), claiming arsenic had been found upon analyzing paper collars, I hasten to disabuse the public of such false representations of a nameless M.D.

This works probably prepares more than three-fourths of all the cloths used in the manufacture of paper collars in America, an amount which will probably exceed 6,000,000 running yards the present year, including all the cloths used by the Goldsmith and Hoffman Collar Co., the American Collar Co., and Jas. L. Libby, of New York; the Reversible Collar Co., of Boston; and Geo. W. Tapley, of Springfield, Mass.

We also do all the "combining"—uniting of cloth and paper—and finishing the united stock ready for cutting into collars and cuffs, for the Goldsmith and Hoffman Collar Co., of New York, and may, I think, be considered competent authority to testify concerning materials used in producing paper collar stock.

I therefore explicitly deny, in the most emphatic manner, that any salt of arsenic, lead, zinc, tin, or other poisonous or deleterious substance is used in the preparation of paper collar stock. The cloths are "stuffed" with a mixture of starch, clay, terra alba, and the most harmless salts of lime, magnesia, or barium, materials as harmless as so much beach sand either to the skin or in the stomach. When combined with paper they are "coated" with similar substances, held in place by fine glue, and with the addition of pure beeswax and French talc to take a high finish.

The public mind has been put in such a condition of alarm by the recent scrap book "developments" of an ignoramus concerning alleged adulterations of food that it is peculiarly sensitive, and a little item such as that in your paper, uncontradicted, may seriously injure a very important, legitimate, and carefully conducted industry.

Will you, therefore, kindly give prominence to this unequivocal denial of the entire facts quoted, by

Yours very truly,
SPENCER BORDEN, Agent,
Fall River Bleachery.

Fall River, Mass., Sept. 17, 1879.

[Our correspondent has entirely mistaken the meaning of the item complained of.

In our issue of March 1, notice was taken of a case of arsenical poisoning in Denver, Colorado, which was traced to arsenic used by the patient's laundress to give a polish to starched linen. The extract from the *Science News* says that the case had attracted attention in the English papers, leading to an examination of the paper collars and cuffs worn by a patient showing symptoms of arsenical poisoning. The doctor reported the presence of arsenic in the collars. There was no intimation however that the collars were of American make.

It may be proper to add that a recent official analysis in London of certain German collars, reported to contain arsenic, proved them to be entirely free from that or any other deleterious substance.]

Famine and Disease.

Reviewing the reports on the Madras famine submitted by Dr. Cornish, Sanitary Commissioner of that Presidency, the Commission has arrived at the following conclusions: First, that the same atmospheric conditions which produce scarcity of food produce also epidemic disease; secondly, that a large proportion of the mortality of a famine season is due more to epidemic disease than absolutely to want of food, although the destructiveness of an epidemic is increased by the fact that people half starving or ill fed are less able to withstand disease; thirdly, that a point in the process of chronic starvation, when nutriment no longer sustains life, is often reached before people can obtain or will seek relief at a distance from their homes.

A SUGGESTION TO ADVERTISERS.

The publishers of this paper are happy to announce to their advertising patrons and others, that the SCIENTIFIC AMERICAN has attained a regular circulation of 50,000 copies a week—exclusive of the SCIENTIFIC AMERICAN SUPPLEMENT, the latter of which has, next to this paper, the largest circulation of any of its class published in this country.

Manufacturers and dealers in every class of machinery; engineers and others wishing employment; patentees wishing to sell rights, or engage parties to manufacture on shares, will find no other medium so advantageous as this paper in which to advertise their wares or make known their wants. The publishers not only assure their advertising patrons that the present issue exceeds 50,000 copies, but they guarantee that every succeeding issue during the year—1879—shall not be less than *fifty thousand copies every week,* and the indications now are that it will be greatly in excess of that large number before the year closes.

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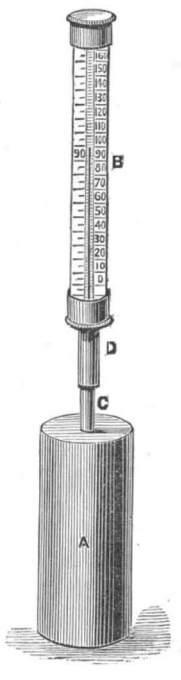
For rates see terms at the head of our advertising pages, or write to the publishers, MUNN & Co., 37 Park Row, New York.

The Sensible Warmth of the Air.

At the recent meeting of the British Association, Professor George Forbes gave an account of an instrument for determining the sensible warmth of the air. By the term "sensible warmth" is meant not the physical temperature which would be measured by an ordinary thermometer, but what might be called the physiological temperature or warmth of the skin as is estimated by nervous sensation. The sensation of heat and cold by the human subject does not depend entirely on the physical temperature of the air, but on that combined with its degree of humidity, and the rapidity with which evaporation is taking place from the surface of the body, which is influenced by both moisture in the air and the rapidity of its movement in the form of wind. It is well known that with the thermometer standing at zero (Fahr.), a person may stand in a still air without feeling as cold as he would feel if he were exposed to the wind with the thermometer at 30 degrees; the reason of this is that the amount of sensible warmth is determined by the degree of rapidity with which heat is transferred from the skin to the surrounding air.

In still air there are formed around the body layers of warm air which protect it from the chilling influence of the colder air beyond; when, however, the air is in motion these layers of warm air are removed as fast as they are formed, cold air supplying their place; the body, therefore, has a far greater demand upon it of heat than before, and a feeling of cold is the result. The thermometer is but a very poor indicator as to whether on a certain day extra clothing is advisable or not, and there can be little doubt that an instrument which, by being affected in a similar manner to the human body, can indicate the sensible warmth of the atmosphere must prove of great value not only in hospitals, and for invalids generally, but it must be valuable to the climatologist and horticulturist.

We illustrate the instrument devised by Professor Forbes, which is exceedingly simple. A is a cylindrical vessel of tin plate filled with boiling water, which can be kept hot for several hours by inclosing the vessel in a case thickly padded with felt or some very slow conductor of heat. Through a sort of stuffing box in the center of the top of this vessel slides a copper rod, C, which dips at its lower end into the hot water, and at its upper is attached to the brass socket, D, which incloses on all sides the bulb of a thermometer, B, the reading of which indicates the temperature of the metallic mass, D. Now the temperature of this mass is affected by two things; first, by the conduction of heat by the rod, C, from the water in the vessel, A, which is fairly constant; and, second, by the rapidity with which that portion of the copper rod, C, which is exposed to the air, parts with its heat to the atmosphere, and this may depend either upon the length of the rod, C, which is exposed between A and D, or upon external atmospheric conditions; but as it is these conditions which the instrument is intended to determine, the length of the rod exposed is made variable by being capable of sliding in and out of the heating vessel, A. In using the instrument, the vessel, A, is first filled with boiling water and inserted in its padded box, and the whole apparatus is placed in an exposed position, and the length of the rod, C, which is exposed to the cooling influences of the atmosphere, is so adjusted that the thermometer gives a constant reading, such, for instance, as "blood heat," *i.e.*, 98 degrees. When the thermometer has become stationary at this point, the length of rod exposed to the air is a measure of the sensible warmth of the air.



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ENGINEERING INVENTIONS.

Mr. George Cooper, of Augusta, Ga., has invented an improvement in cotton and hay presses, which relates to the combination of an engine and valve reversing gear with the follower of a press and the mechanism for operating the follower; also, to the employment of an automatic stop motion in connection with the engine and follower.

Mr. Absalom W. Cain, of Harrisburg, Ill., has invented a novel and apparently effective car coupler, which will permit the uncoupling of the cars from their tops, so that all the risk to life and limb that is incident to the ordinary methods of coupling or uncoupling by going between the cars is obviated.

Messrs. T. R. Gibson and M. F. Seeley, of Fremont, Neb., have patented an apparatus to be applied directly to the car wheel for the purpose of starting the car. It consists of a lever having fixed at one end a hook, which serves as a fulcrum, and near the same end a long hook which is pivoted on the lever.

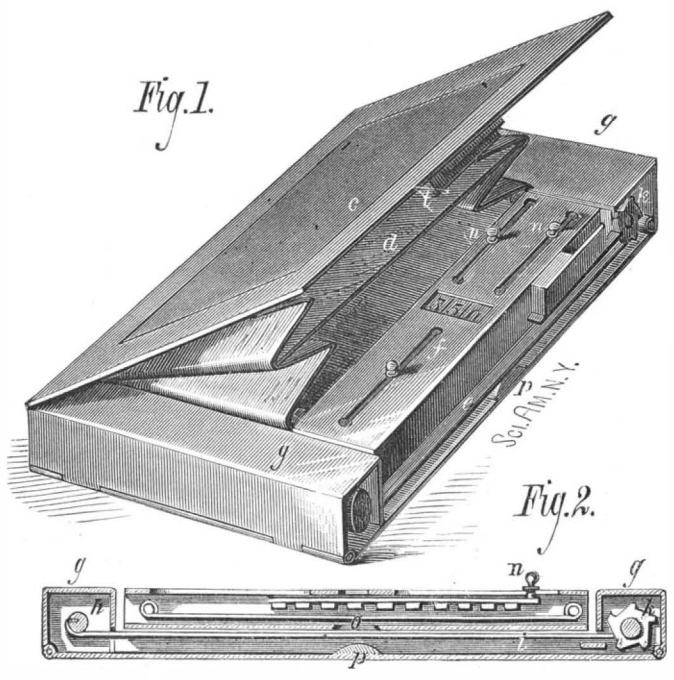
Mr. John C. Montgomery, of Palmetto, Tenn., has invented an improvement in water wheels and gates, which consists in a water wheel composed of a hub having a flat upper side, a convex lower side, a peripheral ring, made of greater depth than the hub and curving under it, so as to be of less diameter at the bottom than at the top, and a series of interposed curved buckets, which receive water at the top and discharge the same downwardly and inwardly to the center of the wheel.

NEW RECORDING POCKETBOOK.

The pocketbook shown in the accompanying engraving is the invention of Mr. Hugh C. Baker, of Hamilton, Ont., Canada. It is fitted with devices for registering or printing figures on a strip of paper by the act of closing the pocketbook, the object being to keep an accurate account of money taken from the pocketbook from time to time without using pen or pencil.

Fig. 1 is a perspective view representing the book open. Fig. 2 is a longitudinal section of the recording apparatus. The bottom, back, and hinged leaf or cover, *c*, are preferably made of thin sheet metal and covered and lined with leather or other material. At each end of the bottom plate there is a hinged box, *g*, each containing a roller for carrying a strip of paper two feet long that extends beneath the box, *f*. One roller is provided with a milled disk for convenience in turning it; the other has a ratchet wheel, *k*, that is engaged by a spring pawl whenever the book is closed, thus moving the paper strip so as to present a fresh surface to the type.

The pocketbook shown in the engraving has three lines of type, each containing the numbers from 0 to 9, so that any sum below 1,000 in dollars, or any sum below $10 in cents, may be recorded. The types are carried by three flat strips



BAKER'S RECORDING POCKETBOOK.

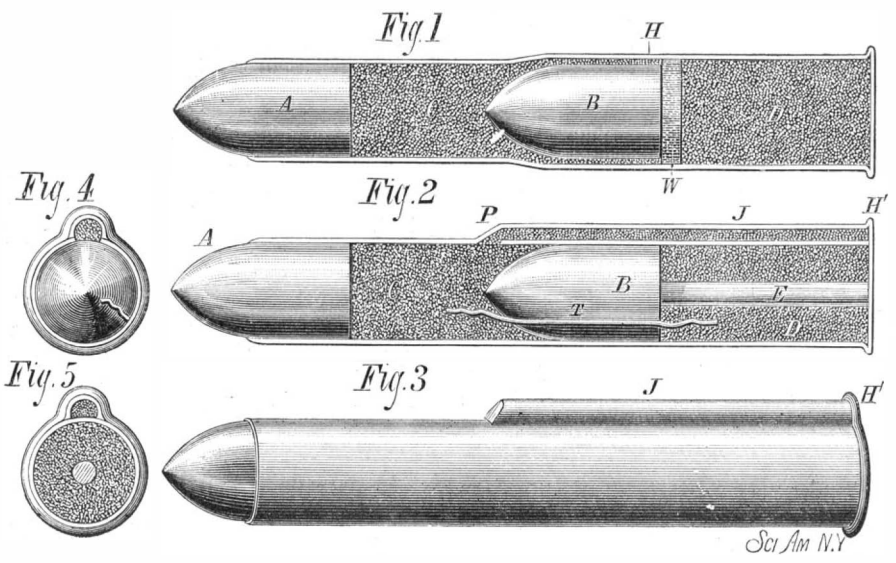
that move under the top of the box, *f*, and each is provided with a stud, *n*, by which it is moved. In the underside of the box, *f*, there is a transverse slot, *o*, and immediately below this there is an elastic pad, *p*. The ink ribbon is carried by rollers at the ends of the box, *f*, and extends under the type and over the paper strip, and is moved by turning the small knobs seen projecting from the inner side of the box, *f*.

The cover, *c*, is provided with a projecting edge, *t*, that presses upon the upper side of the box, *f*, first moving it downward so as to cause the rotation of the ratchet wheel, then carrying it still further until the type, the ink ribbon, and the paper are brought to bear upon the pad, *p*, thus making an impression of the types upon the paper. The ordinary pressure used in closing the purse is sufficient to make the impression. The backs of the strips carrying the types carry figures of the same value as the types underneath, so that the types may be readily adjusted.

The pocketbook is simple in its construction, and all of the parts are readily accessible for adjustment. The paper strip, in addition to the use already mentioned, may be used as a memorandum, as it extends across the book. If desired items may be jotted down opposite the figures.

THE TYLER CARTRIDGE.

We illustrate herewith a new departure in cartridges, and one which the inventor claims will practically double the capacity of army rifles and revolvers. This invention consists in making the cartridge with a shell capable of taking in a number of balls, each ball supplied with a separate charge of powder, the charges of powder being separated from each other by means of easily combustible wads, the whole being arranged so that the charge of powder belonging to the foremost ball is always first exploded. This charge of powder, when fired, besides expelling the foremost ball from the barrel of the gun, ignites a combustible wad resting on the charge of powder belonging to the second ball. The wad, burning through, ignites the second charge of powder, which expels the second ball from the barrel, and ignites a combustible wad resting on the charge of powder belonging to the third ball, and so on for any number of balls, charges of powder, and combustible wads until the cartridge is emptied. In practice, however, the inventor thinks that a cartridge containing only two balls will be found the most effective, as it can be used more conveniently in a magazine rifle than a cartridge carrying a larger number. Fig. 1 shows a form of this cartridge, which was patented April 1, 1879. The internal diameter of the shell is slightly greater than the caliber of the balls employed, except near its front end, where its diameter is reduced until it fits the balls; into this portion of the shell the front ball, A, is placed so that its point projects from the shell. The charge of powder, C, belonging to the ball, A, fills the space in the shell between this ball and the ball, B, and also between the ball, B, and the walls of the shell, thus resting on the combustible wad, W, as shown in the illustration. A ring of fulminating powder, H, is placed around the inside of the shell in contact with the charge of powder belonging to the ball, A. When this form of the cartridge is used, the hammer of the rifle will not strike against the base of the cartridge, but at a point on the side adjacent to the fulminate, H. The fulminate is placed in a ring around the inside of the shell, so that on whatever side of the shell the hammer strikes an explosion will follow. The charge of powder, C, expels the ball, A, from the gun, and at the same time ignites the combustible wad, W, resting on the charge of powder, D, belonging to the ball, B. This wad, burning through, ignites the charge, D, when the ball, B, is also expelled. The wads are used to separate the charges of powder, so that no more than one charge can be exploded in the same barrel at the same time. Of course the wads can be so made that any desired length of time will intervene between the different explosions. Fig. 2 shows a form of this cartridge in which is used a reloading shell, and which is fired by the hammer striking from the rear. In this form of cartridge the hammer strikes against the fulminate, or a percussion cap, placed at H, and thus ignites the powder in the passage, J, which in turn ignites the charge, C, through the opening, P, in the shell. E is a rod of metal attached to the base of the shell to prevent the ball, B, from being forced out of position by the backward pressure of the charge, C, when exploded, and also to prevent any undue compression of the charge, D, from the same cause. In this form of the cartridge, the inventor proposes to employ a time fuse, T, passing through the ball, B, for the purpose of effecting communication between the two charges of powder, in place of the combustible wad shown in Fig. 1. The small opening in the ball, B, through which the fuse, T, passes, is closed by the pressure of the charge, D, when exploded, by means of a simple device which will not add to the cost of the cartridge, and thus all escape of gas through this opening is avoided.



TYLER'S IMPROVED CARTRIDGE.

Fig. 3 is a perspective view of the cartridge shown in detail. Fig. 4 is a transverse section taken through the second ball of the cartridge, shown in Fig. 2. Fig. 4 is a transverse section of the same cartridge taken through the second charge of powder. Fig. 2 shows the exact size and shape of a cartridge containing two 0·45 caliber balls, regulation army weight, with a suitable charge of powder behind each ball.

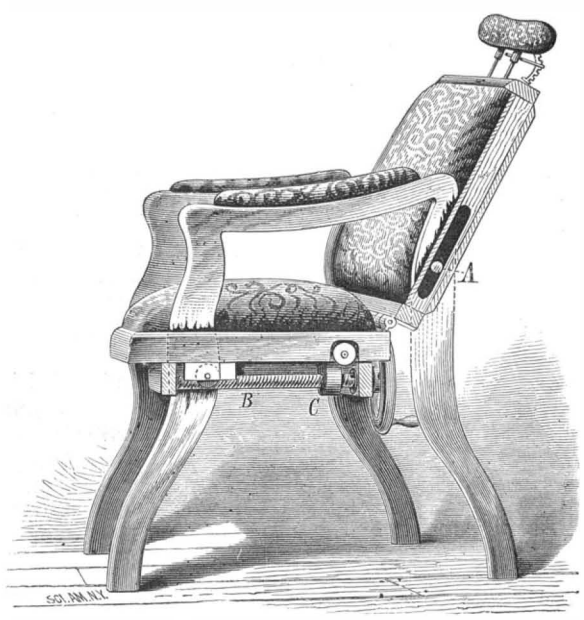
Mr. Tyler proposes to adopt the well known Winchester army rifle to the form of cartridge shown in Fig. 2, furnishing a weapon carrying nine cartridges, each containing two balls, and these eighteen balls can all be discharged in about the same length of time required by the Winchester rifle to discharge nine of the ordinary cartridges. He expects to use the same form of cartridge in an army revolver, discharging twelve balls in the same time now required to discharge six. A very slight movement of the barrel, say one sixteenth of an inch, either to the right or to the left, between the different discharges from the same cartridge, will give sufficient divergence to the different balls, so that no two balls, after having traveled a comparatively short distance from the muzzle of the piece, can possibly strike the same individual.

It requires no argument to show the deadly nature of this invention upon the battle-field crowded with belligerents. A magazine rifle, using a cartridge carrying two balls, is equal to a rifle using a cartridge carrying only one ball under any possible conditions, while in the majority of cases the cartridge with two balls will practically double the capacity of the piece. The same may be said of an army revolver. Any rifle or revolver using the Tyler cartridge can also use a cartridge with one ball, thus rendering such rifles and revolvers suitable for sporting purposes, target practice, etc.

For further information address the inventor, Mr. John E. Tyler, Roxobel, Bertie county, N. C.

NEW BARBER'S CHAIR.

The accompanying engraving represents an improved barber's chair recently patented by Mr. Ludwig Marx, of West



MARX'S BARBER'S CHAIR.

Chester, Pa. It is very easily and quickly adjusted to suit the comfort of the occupant, and is simple and substantial. The seat is supported by a frame that rests upon rollers, and the back is hinged at its lower edge to the seat frame, and is provided with a slot for the rod, A, upon which the back both turns and slides as the seat is moved out or in.

A screw, B, journaled in the chair frame, engages a nut, C, attached to the bottom. By turning the screw shaft in one direction the seat is moved forward and the lower part of the back with it. The back turns on its pivot, and is thus inclined more or less as may be desired. By reversing the movement of the screw the seat is drawn back and the back is turned up more or less. In this way the chair can be adjusted in various positions, the movement being limited only by the length of the screw.

The American Arctic Expedition.

A dispatch to the Navy Department from Lieut. De Long, commanding the Arctic steamer Jeannette, states that the expedition arrived at St. Lawrence Bay, Siberia, August 25, All the party were well. The Jeannette was to leave for Cape Lodge Kamen, September 30, with the expectation of reaching Wrangal Land before the close of the season.

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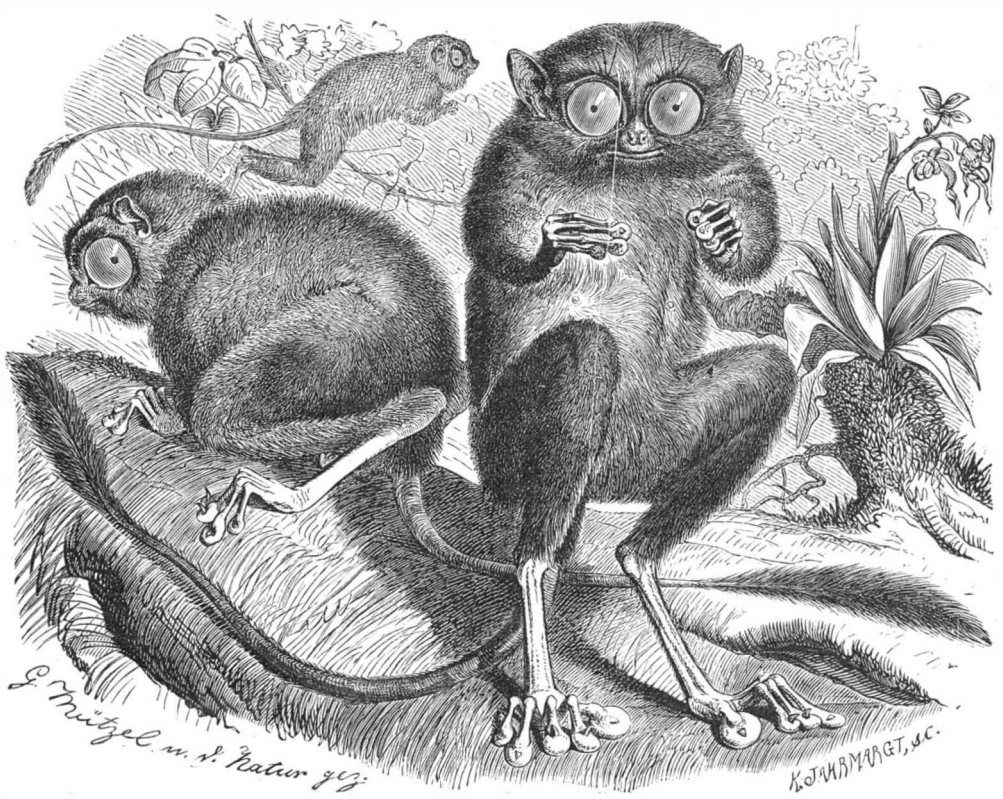
THE TARSIER.

This curious little creature is a native of Borneo, Celebes, the Philippine Islands, and Banca. From the latter locality it is sometimes called the Banca tarsier. It is also known as the podji. The color of the tarsier is a grayish brown, with a slight olive tint washed over the body. A stripe of deeper color surrounds the back of the head, and the face and forehead are of a warmer brown than the body and limbs. The hands are of extraordinary length in proportion to the size of the creature. This peculiarity is caused by a considerable elongation of the bones composing the "tarsus," or back of the hands and feet, and has earned for the animal the title of tarsier. The fingers and toes have at their extremities, upon their under surfaces, convex pads, and at the top short triangular nails or claws. Its eyes are of extraordinary size and very convex. It is a tree-inhabiting animal, and skips among the branches with little quick leaps that have been likened to the hopping of a frog.



TARSIER.—(*Tarsius Spectrum.*)

Fusing Metals without Fire.

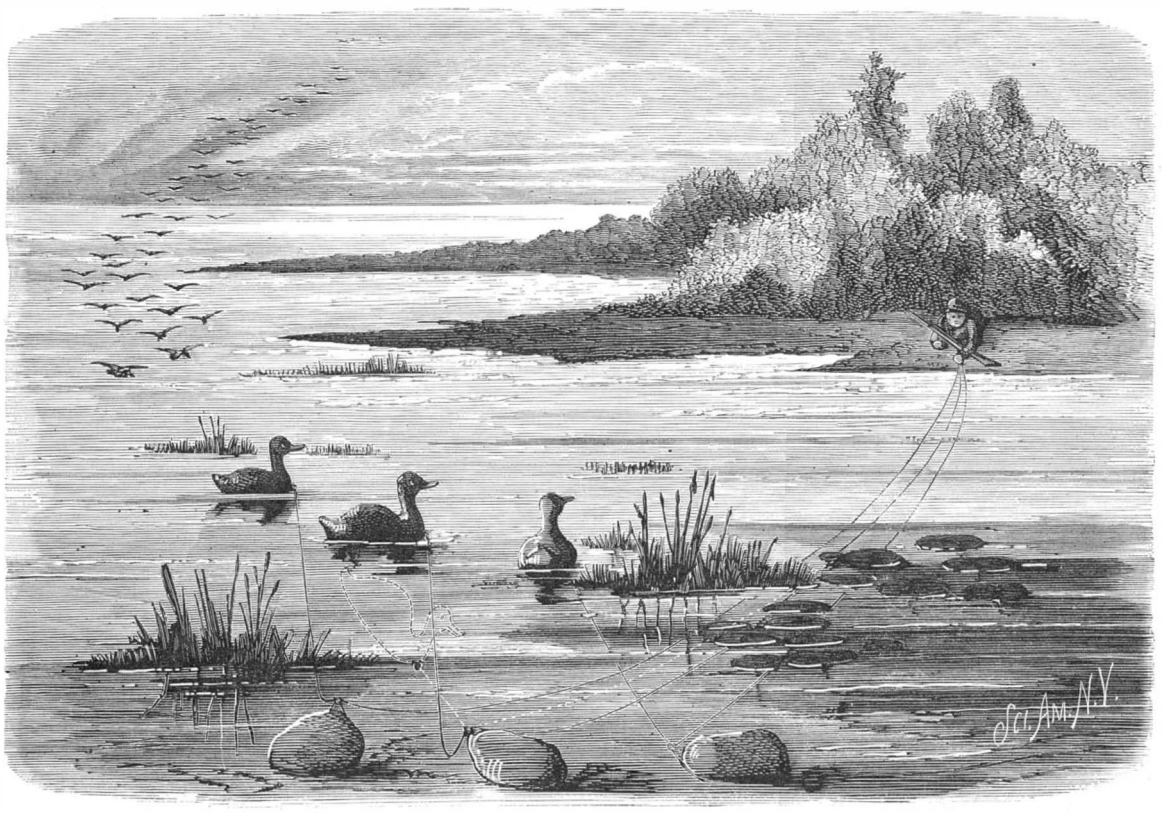
Jacob Reese, of Pittsburg, Pa., puts forth some remarkable claims in regard to an alleged new discovery in metallurgy. He says he is able to melt instantly a bar of cast steel one inch in diameter—which cannot be fused in less than five minutes in the highest furnace heat attainable—simply by throwing against it a column of air having a velocity of 25,000 feet a minute. The instant the air touches the metal fusion takes place. He says further:

"By furnace heat it requires many hours, and sometimes many days, to anneal metals. By a recent discovery which I have made, I can anneal bars of iron or steel at the rate of one foot per second, thus increasing the ductility of the metal 100 per cent, without the use of other fuel than that contained in the metal itself. I simply unlock the occluded (latent) heat. It becomes sensible and enlarges the metal, and by the method of doing this the enlargement is made permanent, that is, it does not contract to its original limit.

"Now, annealing and fusing iron and steel in one second of time may seem absurd, but it is nevertheless a fact, and reduced to practical utility in the arts."

DECOYS FOR WILD FOWL.

The annexed engraving represents a novel decoy for wild fowl, recently patented by Mr. Edmond Redmond, of Rochester, N. Y. The inventor applies a cord to the common decoy, and runs it through an eye or pulley attached to the sand filled bags in the bottom of the stream, thence to the shore, where the sportsman, by dexterously pulling the cords, causes the decoys to move and dive in the water like living birds. In running water, or where the wind prevails, the decoy may be allowed to move with the current or by the action of the wind, and may be drawn back by the cord.



REDMOND'S DECOY FOR WILD FOWL.

Some Ancient Monsters.

Recently Professor Cope, of Philadelphia, gave to the San Francisco Academy of Science a description of two lately discovered fossil animals. One was an enormous vertebrate, somewhat resembling an aquatic kangaroo, named the *Camarasaurus supremus*, whose neck was 9 feet in diameter, whose hind legs were 20 feet long, whose spinal vertebræ were 56 inches across, and which must have been 72 feet long by measurements carefully taken. This animal could walk in forty feet of water and catch its prey with its fore paws. He also described another similar monster whose spinal vertebræ were 6 feet across and whose hind legs were 40 feet long, with carnivorous teeth placed in the upper and lower jaws like shears, so as to cut up animal food by traversing each other in the most perfect manner. The bones of the lower half of this animal were solid and very heavy, to keep its feet down in the water, while bones in the upper half of its body were built in honeycombed layers as thick as pasteboard, strong, but very light and buoyant in water. This monster has been named *Amphicœlias fragilissimus*, and must have been considerably over 100 feet in length. Both animals have large and powerful tails like kangaroos, and when catching their food in the water must have appeared as if on three-legged stools, the tail acting as an equal support of the tripod.

Bees Gathering Honey from the Catalpa.

At a recent meeting of the Philadelphia Academy of Natural Sciences, I called attention to the fact that there existed large patches of nectariferous glands on the under side of the leaves, in the axils of the veins, of *Catalpa bignoides*. Up to the present time the proof that the glands in question were nectariferous rested only on the evidence of the taste of the secreted fluid and the presence of ants of both red and black species, apparently feasting upon the nectar. Since then I have found the common honey bee gathering the nectar from the foliar glands with as much industry as from the flowers, the latter of which at the time the observation was made having fallen, so that there was positive evidence that the glands alone attracted the bees. Furthermore, the bees were seen to introduce their tongues into the axils of the leaves where the secretion was present in a visible quantity on the gland, and lap it up as when getting the nectar from flowers. The bees engaged at this work carried no pollen at the time, and were apparently devoted to getting the honey only.

These observations place the question of the saccharine nature of the secretion beyond any doubt, and make it probable that the catalpa is valuable as a honey plant, and deserves a place in lawns, parks, and pleasure grounds, on account not only of its beauty, but also from its economic value to the bee culturist.—*John A. Ryder.*

SOME RECENT AMERICAN PATENTS.

An improved envelope has been patented by Mr. Solon P. Cady, of Peterborough, N. Y. It consists in an envelope having a short slit cut in its face in such position that when a stamp is placed on the envelope the slit will be adjacent to one edge of the stamp, whereby a proper tool may be inserted in the slit beneath the stamp and the contents of the envelope protected while the stamp is being punched.

An improvement in roasting ovens has been patented by Mr. Henry C. Atkinson, of Franklin, Ky. The object of this invention is to provide an oven to be placed on the outside of a stove or range, for cooking purposes. The oven is a removable one, and is to be set on the collar of a cooking stove or range.

An improvement in carboy trunnions has been patented by Mr. Samuel M. Holton, of Battle Creek, Mich. The object of this invention is to provide a device by which a carboy can be tipped and its contents poured out easily and without danger or inconvenience to the operator.

Mr. Jesse E. Nale, of Merchantville, N. J., has patented an improved pump, which is so constructed that the water contained in the pump barrel may be allowed to flow out, so that it cannot freeze in the barrel and injure the pump or prevent its working.

Mr. William Sias, of West Claremont, N. H., has invented an improved washing machine, in which the action is similar to hand washing; the dirt settles at the bottom, and will not be rubbed again in the clothes after being washed out.

An improvement in mowing machines has been patented by Mr. John H. Green, of Londonderry, Ohio. The object of this invention is to improve the construction of harvesters and mowers in such a way that, should the driver leave, fall, or be thrown from his seat, the cutters will be thrown out of gear and the cutter bar released, so that it will turn around parallel with the line of draught, if the machine should be drawn forward, to prevent the driver from being killed or injured should he fall in front of the cutter bar, and render the machine less liable to receive or inflict injury should the team run away.

Mr. George R. Huff, of Tomah, Wis., has patented an improved device for filing saws, which is so constructed that any one, even without practice or skill, will be able to file a saw true and accurate. The invention consists in a sliding block, having a longitudinal dovetailed groove in its lower side to receive the saw, and one straight and two inclined cross grooves in its upper side, for guiding the file and file holder.

Concerning the Memory.

The *Medical Press and Circular* gives some entertaining statistics of memory, from M. Delaunay. The inferior races of mankind, such as negroes, the Chinese, etc., have more memory than those of a higher type of civilization. Primitive races which were unacquainted with the art of writing had a wonderful memory, and were for ages in the habit of handing down from one generation to another hymns as voluminous as the Bible. Prompters and professors of declamation know that women have more memory than men. French women will learn a foreign language quicker than their husbands. Youths have more memory than adults. It is well developed in children, attains its maximum about the fourteenth or fifteenth year, and then decreases. Feeble individuals of a lymphatic temperament have more memory than the strong. Students who obtain the prize for memory and recitation chiefly belong to the former class. Parisian students have also less memory than those who come from the provinces. At the *Ecole Normale* and other schools the

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pupils who have the best memory are not the most intelligent. The memory is more developed among the peasantry than among citizens, and among the clergy than among the laity. The memory remains intact in diseases of the left side of the brain, and is much affected in those of the right, from which it may be inferred that the right side is more the seat of this faculty than the left.

From a physiological point of view memory is diminished by over-feeding, by physical exercise, and by education, in this sense, that the illiterate have potentially more memory than those who know how to read and write. We remember, moreover, better in the morning than in the evening, in the summer than in the winter, and better in warm than in cold climates.

How Old is Glass?

The oldest specimen of pure glass bearing anything like a date, is a little moulded lion's head, bearing the name of an Egyptian king of the eleventh dynasty, in the Slade collection at the British Museum. That is to say, at a period which may be moderately placed as more than 2,000 years B.C., glass was not only made, but made with a skill which shows that the art was nothing new. The invention of glazing pottery with a film or varnish of glass is so old that among the fragments which bear inscriptions of the early Egyptian monarchy are beads, possibly of the first dynasty. Of later glass there are numerous examples, such as a bead found at Thebes, which has the name of Queen Hatasoo or Hashep, of the eighteenth dynasty. Of the same period, are vases and goblets and many fragments. It can not be doubted that the story preserved by Pliny, which assigns the credit of the invention to the Phœnicians, is so far true, that these adventurous merchants brought specimens to other countries from Egypt. Dr. Schliemann found disks of glass in the excavations at Mycenæ, though Homer does not mention it as a substance known to him. That the modern art of the glass blower was known long before is certain from representations among the pictures on the walls of a tomb at Beni Hassan, of the twelfth Egyptian dynasty; but a much older picture, which probably represented the same manufacture, is among the half-obliterated scenes in a chamber of the tomb of Thy, at Sakkara, and dates from the time of the fifth dynasty, a time so remote that it is not possible, in spite of the assiduous researches of many Egyptologers, to give it a date in years.

Impure Water—Toads and Squirrels in Wells.

The quantity and variety of filthy matter which is found deposited at the bottom of wells, in some localities, are astonishing. We recently had occasion to examine the *débris* taken from a well which had been cleaned the year previous, and among the accumulations were decaying toads and squirrels. These creatures had been probably attracted by the water, to reach which they had clambered down the wall till they reached the solid rock into which, for several feet, the well had been excavated, when they were precipitated to the bottom, and could not retrace their steps. To obviate a repetition of the same annoyance the stone wall has been removed down to the solid rock, relaid in hydraulic cement, and carried some three feet above the surface of the ground and finished for some distance around the top with cement underlaid with stones. On this solid foundation a curb has been so closely fitted as to exclude even crickets and grasshoppers, which are so apt to find their way into wells.

To those who detest impure water and would avoid perhaps the sickness of an entire family, the above plan, or the adoption of some better precaution against the contamination of wells, is recommended. This is the season when springs and wells are usually low of water, and therefore it is the best time for cleaning the bottom of the latter and repairing the walls if found defective.

Medicated Ice.

Dr. Edwyn Andrew, of Shrewsbury, England, has pointed out the advantages in certain surgical and medical cases of employing medicated ice. He thought the cold was rendered more effective by being combined with the active principles of drugs, and by freezing various medical solutions. In that manner ice might be rendered highly antiseptic, caustic, or styptic. In medical cases, especially of the throat, stomach, and hemorrhages from internal organs, ice might be thus pleasantly used to relieve symptoms and at the same time convey medicine as food to the stomach when the latter would resist them in any other way.

The Lotus in New York.

At the recent exhibition of the New York Horticultural Society, Mr. E. D. Sturtevant, of Bordentown, N. J., exhibited three water lilies, which promise to have great practical value for decorating grounds where there are small lakes. One of the plants was a true Nilotic Lotus, with circular leaves standing above the water, similar in appearance to those of our native *Nelumbium luteum*, and showing large nodding flowers. There were also some cut flowers of the *Nymphæa dentata*, a large flower of purest white—an enlarged copy of our own white water lily, *N. adorata*. Another was a blue variety, and most striking of all was a hybrid from two Indian varieties. The large heart-shaped leaves of this plant floated on the surface of the water, while the flowers were of a delicate pink shade. Mr. Sturtevant declared that these flowers, as well as those of the *N. dentata*, were fully twelve inches in diameter during the warm summer weather. These plants were all grown in the open air.

Concert Rooms.

Mr. Cecil J. Saunders, in a paper read at a late session of the Musical Association, in England, on the Construction of Buildings considered in Reference to Sound, made some very interesting statements and advanced some curious theories. Glass being one of the most elastic of sound reflectors, he was not surprised to find, when listening to a concert at the Crystal Palace, that the echo of one note returned to him at the same instant that he received the next note direct. He said that light had a remarkable modifying influence on sound, a statement which was corroborated by gentlemen who took part in the discussion that followed the reading of the paper, although the general opinion seemed to be that the cause lay not in the light itself but in the heat produced by it. Mr. Saunders then described the hall that he would have built to contain five thousand auditors. It would be a square room with rounded corners, and the orchestra in one of the corners. The audience would face the orchestra, and would thus look toward the converging walls. The number of performers provided for would be 700, as this was probably the limit of really good work, the orchestra seats rising tier above tier into the angle of the building. The organ should be chiefly below the orchestra, so as to allow of a low ceiling. By placing the orchestra in the angle of the building, very few of the audience can receive an echoed sound, The seats for the audience should be circular, so as to give every one a direct view. The floor should rise gradually toward the back of the room. The best material for the ceiling is wood. Ordinary plastering is one of the most perfect non-conductors of sound used in building. Zinc would be nearly as cheap, and perhaps even more efficacious than wood. The walls at the back of the orchestra should be covered with looking glass, which has a strong reflecting power for sound. These glasses, however, should not be bedded in flannel as usual, but allowed to vibrate with every note. Boarding or cement would be best for the rest of the walls. Cement is hardly resonant, but it reflects sound well. Stone would do better, but its cost is too great. No doubt a good deal of the resonance of cathedrals is due to the surface of smooth and hard stone inside them. For quartet performances, a movable screen behind the players or singers might be arranged so as to re-enforce the sound in its forward direction. This screen should be of two thicknesses of wood, with a sounding-board at the top inclined slightly upward. Empty and half-empty rooms always echo, so that the best way of avoiding an echo is by low prices and a good programme. When there is a certainty of a small audience in a large hall, heavy curtains should be hung from the ceiling, so as to reduce its size.

Luminous Powders.

Two patents have been recently taken out in England for phosphorescent powders. One of the patentees states, in his specification, that his object is to obtain and utilize at night-time the light absorbed during the daytime from sunlight or an artificial light, either by employing the powders after exposure, or by augmenting their brilliancy by means of electricity. The powders are made by taking 100 parts by weight of carbonate of lime, and phosphate of lime produced by the calcination of sea shells; secondly, 100 parts of lime rendered chemically pure by calcination, and after the above are mixed, 25 parts of calcined sea salt are added, then 25 to 50 per cent of the whole mass of sulphur incorporated therewith by sublimation, 3 to 7 per cent of coloring matter in a powdered form composed of mono-sulphuret of calcium, barium, strontium, uranium, magnesium, aluminum, or other minerals or substances, producing the same appearances, *i.e.*, which become luminous in the dark.

The other patentee says of his phosphorescent substance, that he prefers calcined oyster shells combined with sulphur by exposure to sufficient heat, or a paste formed of neutral arseniate of baryta and gum tragacanth or sulphide of strontia, or sulphide of barium in combination with a small percentage of magnesia. For rendering walls or surfaces for advertising or other purposes luminous in the dark, they are coated with an adhesive substance. The phosphorescent substance is then spread over the surface, and then coated with transparent varnish or other transparent substance.

Coal Mining in Pennsylvania.

The total amount of anthracite mined in Pennsylvania during the coal year, ending Sept. 6th, was 17,123,275 tons, an increase of 6,601,043 tons over the product of the previous year. The bituminous coal mined was 2,372,568 tons, an increase of 156,073 tons. The total coal product for the year was 19,495,843 tons, against 12,738,727 tons for the coal year 1878.

An Incident of the Times.

From every part of our country prosperity seems to abound in almost every department of trade, and the demand for all kinds of machinery and implements, and the steam appli ances for driving and making them, seems to be greater than for a long time past. The answer of one of our regular advertising patrons to our inquiry if his goods were in demand nowadays, is no doubt what most other manufacturers who advertise their goods experience.

All last year, says the gentleman, parties would write to know how low a machine could be furnished, and then, before ordering, they would write several times to get better terms. Now, says the manufacturer, things are different. Orders flow in faster than can be filled, and the inquiry is no longer how low the goods can be furnished, but how quickly.

Curiosities of Fires.

At the recent meeting of the National Association of Fire Engineers, Mr. M. Bennett, Jr., delivered a very interesting address, from which we take the following:

Of the 50 per cent of fires, more or less, not accounted for by incendiary origin, many undoubtedly originate from not yet understood causes. New hazards, from new or old processes, are daily developed, and some most curious facts in this connection have come within the range of my own personal observation.

Some months ago, in passing a prominent picture store in the city in which I reside, on a Sunday, my attention was attracted by the actions of a boy, which seemed to betoken lunacy He would stand with his back against the large show window outside for a few minutes, then turn about and carefully gaze within; then again plant his back against the window Curious to solve what seemed to be a case of idiocy in a bright looking boy, I asked the cause of his strange actions. Directing my attention, I discovered that the rays of the sun through the glass formed a focus in the middle of a large and valuable chromo, which just commenced to smoke at this identical point, and would evidently soon be in flames. The boy stated that he was a clerk in the store, but had not his key, and discovering the state of things, he planted himself as a patent living fire screen to protect the picture from the sun's rays.

A well-known Hartford adjuster, while recently sitting in his room in one of our finest business blocks, saw his silk umbrella, standing in the corner, quietly take fire and consume before his very eyes, and with no little difficulty he stopped the fire from spreading Investigation proved it to have caught from the concentrated rays of the sun reflected from his graphoscope innocently resting on his table. Without a doubt, we do not understand many actual causes of fire, and numerous conflagrations are due to far different causes from those suspected or guessed at. In the case mentioned, had the fire occurred during the absence of the owner, and the block consumed, as it might easily have been, it would have remained one of those unsolved mysteries which surround so many fires.

Animals also have played a most important part in the world's history. Romulus was the founder of Rome, but a wolf was the finder of Romulus. Rats saved New York (so the legend goes), geese saved Rome; but the cow Chicagoed all of us. The lion has been called the king of beasts, and the elephant the largest, but in our mutual profession the cow has played the chiefest role. Alas that the cow was ever invented, or, if invented, should have attempted, like many another calf, to have kindled fire with kerosene. If the cow had been kept out of the ark we would willingly have risked small pox and cheerfully accepted some substitute for milk as an eleven o'clock beverage; and really, with so much fresh water about, we see no reason for Noah's taking her in. The fiddler also played *his* part, for history informs us that Nero fiddled while Rome burned. What tune, we regret to note, has not been handed down, for it would be a most appropriate selection for the bands at our firemen's tournaments. A long one it must have been, as Rome burned seven days.

But why is it that, in spite of all the wonderful inventions and marvelous increase in fire extinguishing facilities, and in the skill, exactness, and military precision of our fire departments, losses by fire show such an alarming increase? Because the moral and physical hazard, the former influenced by the most outrageous and prejudiced legislation, and the latter by diabolical inventions, based on man's cupidity, have not only kept pace, but caught up and passed that wonderful point which man's inventive and executive genius had reached.

When our grandmothers used to go to church with their footstoves and freeze one foot solid while warming the other, or sit with a hot brick in their laps, so intent on the sermon that they did not notice that their clothes were on fire until it had burned through to the skin, such a thing as a church burning from a defective flue was unknown The old-fashioned tallow dip, when the only fire extinguisher known was a mammoth pair of snuffers, reminding one of a mouse trap on a pair of scissors, did not explode, while the fireplaces were so large that the most explosive qualities of the biggest black log failed to force a cinder beyond the hearth stone. Neither did whale oil, by the light of which our grandmothers used to let down the stitches in their knitting work, and which was the only medicine known in the house to cram down the throats of defenseless children as a bowel regulator. Modern oil somewhat differs from the ancient, and is not of that kind told in the story of the lamp which was supposed to have burned above 1550 years in the sepulcher of Tullia, the daughter of Cicero; for fifteen minutes would be a fair average for a modern kerosene lamp to kill a servant girl and burn up the house. What would our ancestors have said, who bought oil by the pint—and scarce at that—to have seen a modern oil well in Pennsylvania, pouring right from the middle of the earth, unaided by human hands, a stream of this most inflammable compound the size of a man's arm, with a force as though a dozen fire engines were at the other end of it, at the rate of 80,000 gallons per day? More oil in a fortnight than was captured in an entire year by the whole whaling fleet of 600 vessels which sailed from the chief New England whaling ports in the palmier days of whale fishery, while to-day a gallon of sperm oil is as scarce as an old-fashioned whalebone umbrella. The depths of the ocean have succumbed to the depths of the earth.

For the fifteen years ending in 1875 the State of Pennsyl-

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vania alone produced more than 300,000,000 gallons of oil. What would our good New Bedford grandmothers, who looked on 500 barrels as a very good catch, have said to this? With oil at 65 cents a barrel, who cannot afford to burn up?

The success of kerosene is one of the greatest misfortunes for those who have to put out the fires and for those who have to pay for them. But so long as a common kerosene lamp gives as much light as two dozen of the candles of our ancestors, and a gallon of oil at 25 cents gives as much light as 20 pounds of sperm candles, so long we must suffer. The adulteration of kerosene is, next to intentional incendiarism, the most alarming and rapidly-spreading cause of fire, to the suppression of which we ask your strongest influence and assistance.

But how can it be suppressed?

Only by legislation. Here again each of our individual votes will go as far as the wealthiest adulterator's. The apathy of the public on this point is beyond comprehension, and legislation fearfully inadequate to protect life and property against this terrible risk. It should be made a State prison offense to make, mix, or sell any product of petroleum as an illuminating oil that will not bear the standard of at least 120° Fahr., and recent State legislation of the so-called fusel oil or benzine, that the seller shall pay all damages caused by the men who drink it, can well be applied to the manufacturers and venders of this most villainous and certain incendiary.

So, also, the manufacturer of vapor and naphtha stoves, and so-called safety lamps, sold by agents who go about the country deceiving their dupes by experiments, the principal and most convincing of which to the uninitiated is to stick a lighted match into a saucer of the fluid. The innocent victim is naturally ignorant of the fact that none of the petroleum products are explosive *per se*, and that a certain ratio of air to the vapor is necessary to produce an explosion—the maximum degree of violence resulting from eight or nine parts of air to one of vapor; but while great skill is required to make the proper combination to produce an explosion, accident frequently fills the place of skill with the highest success. It is astonishing to note the applications in the Patent Office on ridiculous, ineffectual, and pretended processes for manufacturing naphtha and benzine, merely to deceive the public under false names, called by a most expensive and wicked satire *non-explosives*. One inventor actually obtained a patent for a non-explosive oil, made by adding 20 pounds of potatoes to 40 gallons of naphtha and a few other ingredients, which might have been good for potato bugs, but much better for fire bugs.

It has been hinted that underwriters were not business-wise interested in too great proficiency in the fire department, on the ground, we suppose, that fires are necessary to keep the business good. But absolute perfection, like perpetual motion, is against nature's laws, as at present developed, and, gentlemen, we say, don't spare *us*. Make your departments as near perfect as possible. Prevent if you can; but if fire occurs, put it out as quickly as possible, and we will take the consequences of the injury to *our* business. Do not stop on *our* account. However successful you may be, reach perfection so absolute that fire loss is an unknown quantity. We will trust the memories of Troy, Portland, Chicago, and Boston to keep our business good, long enough, at least, to accumulate a sufficiently large surplus to retire upon.

We used to read, with some pity for their ignorance and lack of civilization, of the Indians when, in wonder lost, they first saw the iron horse snorting through their prairie homes. But what would our even now living ancestors have said in their earlier manhood, when the only fire department was the old-fashioned well in the back yard and a couple of leather buckets in the front hall, or even the later improvement, the old hand engine, with its long arm and a "break her down, boys, aye, break her down, backs and all," to have witnessed instantaneously with the first warning cry of fire from the tongue of the old church bell, the doors of a large building spring open as if by magic, and an immense iron structure on wheels rush out and through the streets, pell mell, puffing, screeching, and snorting, up and down hill, around corners and angles, with the highest speed and accuracy; no horses, no men pulling or pushing, and as soon as they reach the fire half-a-dozen enormous streams instantaneously pouring over the building, until the only fear was from flood, not flame? Methinks the wonderment of the Red Man would have sunk into an eclipse. But letting alone the astonishment your present system, with its wonderful perfection and military precision, would have had on our *forefathers;* only last fall, at a meeting of the Northwestern Association at Chicago, a party of us, ladies and gentlemen, went over to witness an exhibition kindly tendered us by your chief. Among our party was a lady who had traveled over the world, and who had been told beforehand of the wondrous proficiency of its workings, and had every reason to know exactly what to expect. We first called on the fire patrol. As she stood at the head of the stairs, that she might the better see it, the alarm struck. Instantaneously down came the steam whip upon the backs of the equally expectant horses, who, trained and impetuous, jumped from their places before the lash could reach them. Forth leaped with the loud clatter of eager hoofs three elegant specimens of horsehood; the doors of the house opened wide, and a trap door flew up for the exit of the awakened firemen. The men jumped from their beds into their boots, while the bedclothes from every bed in the room, attached with hooks at the bottom, flew upward to the wall in one grand pile, with a lightning like precision which would have done credit to a hangman of the last convicted incendiary. All instantaneously in one grand crash and jump, the men dressed, were seated on the wagon, the horses harnessed and out of the building ready for action. But our lady of travel was so amazed and dazed at all this concentration of skill and ingenuity that she lost both her head and her balance, and tumbled down the whole length of the stairs, while the gallant captain, who had gone through all this and was seated on his wagon in full uniform, had time enough left to jump off and catch her as she reached the bottom. It was said, with a complimentary humor dry enough to produce spontaneous combustion, by a member of that association, in reply to an invitation to visit the engine house in the evening and see the workings of the alarm system, he moved that the visit be made in the daytime, as the last time he went in the evening the steamer got out so quick he couldn't see it. David was evidently no fireman when he wrote in the 39th Psalm, "While I was musing the fire burned," for no fireman ever stopped to muse while a fire was burning.

Ore Smelting at Leadville.

There are now thirteen smelting establishments with twenty-eight furnaces in operation in the Leadville district, a number of them being on Fryer Hill, close by the great mines. The ores are easily smelted and undergo the simplest processes. Some of the ore needs crushing, and it frequently happens that low grade ores are in demand, the lead being needed for fluxes. Sometimes the iron ore found in the mine is used for flux, and in many cases they have to run some of the slag through again to help. The smelting works are all fitted with the newest machinery. A correspondent of the *Herald,* writing from Leadville, says that they are doing well, but encounter a heavy expense from the high cost of coke, which is hauled in wagons from Trinidad, a distance of 200 miles. The needed charcoal is made here in the timbered mountains surrounding the camp.

The method of dealing in ore is simple and wonderfully correct. It is sent from the mine in wagons and dumped into separate bins at the smelting works, then put into a box, quartered, and assayed. It is then again quartered and crushed to a fine power. Half the sample is then given to the miners and the smelter keeps the other half. Each party has his assayer. If the assayers agree, as they nearly always do, the bargain is closed and the miner is paid at once by the assay. If the assayers disagree, then a third disinterested party comes in as an arbitrator. These ores are difficult to sample, and one or two smelters caught playing smart games have to pay more for their ore. The smelter pays New York price for silver said to be in the ore, less five per cent., and $20 smelting charges per ton, and he also pays from $15 to $20 per ton for the lead. The lead and silver are run together into bars of 100 pounds each, and shipped to New York or St. Louis as base bullion. There are numerous advantages in shipping the metals in this way. The freight is lower, the cost of getting bullion to New York being this way only about $25 per ton. There is not much danger of loss by thieves, because thieves seldom steal a pig of lead, and they could not very easily get the metal separated. It goes to Newark, N. J., and is there separated. The value of the lead in the pigs at New York more than pays the cost of freight, separation, hauling, etc. In fact, it deposits the silver in New York free of costs and charges, and is still sold at a neat profit.

The Russian 32-Inch Objective.

A contract, it is said, has been made by Alvan Clark & Sons, of Cambridgeport, Mass., with the Russian government, relative to the great objective for the Imperial Observatory at Pulkowa, for a great telescopic objective. The proposed glass is to be the largest in the world. The contract provides that the definition of the glass shall not be inferior to that of the telescope in the Naval Observatory in Washington, and that the amount of light shall be greater in proportion to the increased area of the objective, allowance being made for the obsorption of light by the glass.

The objective at Washington is 26 inches in diameter; the proposed glass is to be from 31½ to 32 inches in diameter, with a clear aperture of thirty inches. Three years and a half are allowed for its completion—two years to procure the rough disks, and eighteen months for grinding, polishing, correcting, etc., with an extension of time, provided good and sufficient reasons are given for the failure to finish within the specified period. When finished the glass will be mounted in Hamburg. The cost of the glass alone will be $32,000. The material for the glasses will probably be furnished by French manufacturers, the Clarks finding their disks to be most trustworthy.

The cost of the objective is to be $32,000, with $1,000 additional for rough mounting.

Steam Launch of Light Draught.

In our SUPPLEMENT, No. 179, we gave the drawings and dimensions for a stern wheel steam launch (31 feet length) of light draught, 16 inches, as built at the United States Works, Rock Island, Ill., from designs by M. Meigs, United States Civil Engineer. We learn from Mr. Meigs that one of these little boats, in which he has lately made a trip, ran 8½ miles an hour on 110 lb. steam without crowding. He says the boat handles so wonderfully, turns so short, and runs in such shallow water he is confident that when light draught is needed no other construction is so good as the stern wheel.

AGRICULTURAL INVENTIONS.

An improvement in harrows, patented by Mr. Alfred Deisher, of Fleetwood, Pa., consists in making harrow teeth of plates with an inclined cutting edge, wings, a shoulder, and pin. By this construction the harrow is adapted for the additional work of a pulverizer and drill. It is of light draught. It is adapted for working soft or hard soils.

Messrs. L. H. and R. F. Johnson, of Brownsville, Tenn., have patented an improved corn and pea planter. This is an improvement in the class of seed-dropping machines which have reciprocating seed slides that are operated by the rotation of the transporting wheels, or the axle on which they are mounted.

An improvement in grain separators has been patented by Mr. Thaddeus C. Histed, of Junction City, Kan. The object of this invention is to improve the construction of the grain separator for which letters patent No. 199,204 were granted to the same inventor, January 15, 1878, so as to make it more effective in operation. As the grain is conveyed through a spout it passes between the two brushes, by the action of which all smut and dust are removed from the kernels and blown away by the blast from the fan blower.

An improved runner for corn planters has been patented by Mr. Gamaliel S. Rarey, of Groveport, O. The invention consists in providing the runners with V-shaped points, which connect with gauges attached to the runners on either side, and regulate the depth to which the runners extend, while the points throw the obstructions aside and level off the ground.

An improvement in grain binders for harvesters has been patented by Mr. Thomas H. Parvin, of Chicago, Ill. The object of this invention is to furnish an improved binder for binding grain as it is delivered to it from any harvester. The nature of the invention is such that it cannot be described without engravings.

Mr. Solon D. Rice, of Grant, Ky., has patented an improved machine for cutting corn stalks into pieces in the field. It consists of a roller carrying a number of radial knives, which press the stalks to the earth and at the same time cut them.

Mr. Francis C. Frost, of Anoka, Minn., has patented an improved hand corn planter, which is so constructed that the seed may be forced out of the dropping hole at the proper time, so that there can be no failure in dropping the seed. It may be adjusted to drop less or more seed at a time, as may be required.

Mr. Charles M. Sparks, of Earle's, Ky., has invented an improved churning machine, which is simple in construction, convenient, and apparently effective.

Mr. George B. Gay, of Opelousas, La., has patented an improved attachment for turn plows for scraping and sweeping cotton plants, "laying by" corn, and cultivating other plants.

Mr. Benjamin Goodyear, of Carlisle Pa., has patented an improved device for holding and preserving corn selected for seed, whereby it shall be kept safely from rats and mice, and at the same time have opportunity for becoming thoroughly dry. It consists in a board of suitable size fitted with projecting pins, and provided with a wire for being suspended. The ears of corn are placed on the pins. The space between them permits free circulation of air, and the safe, being suspended from a beam or similar support, is not accessible to rats and mice.

The Lay Torpedo.

The Buffalo *News* relates at some length the steps of Mr. Winsor in the torpedo business. The capabilities of the machine being conclusively ascertained, it was entered for the great tournament of torpedo boats at St. Petersburg, some eighteen months ago. The Russian government offered a prize of $50,000 and expenses paid for the best torpedo boat, which would comply with several minimum conditions of speed, ease and destructiveness. There were no less than forty-four torpedo boats entered, the inventors belonging to nearly every civilized nation, but the Lay boat bore off the prize. The Lay invention consists of a boat nineteen feet in length, thirty inches beam, and eighteen inches hold—a long cigar bearing on its point a cartridge containing 100 pounds of dynamite glycerine. Inside is the propelling machinery, equivalent to 35 horse power, being compressed air. Sideboards or planispheres at the side enable the boat to go under or on top of water at the will of the operator. The boat is raised, lowered, and steered by electricity, the medium being a cable of three wires attached to the stern and paid out as the boat rushes toward the marine victim. The operator stands on shore and directs the movements of the boat by a key-board with three keys, each communicating with one of the three wires. One steers the boat, the other raises or lowers it, and the third fires off the charge. A small flag in the middle of the boat indicates its position when on top of the water, and when the flag recedes from ordinary eyesight the operator traces its progress with a powerful glass. It was shown that the Lay boat could be sent out three miles, made to strike an object a foot square, and return to the point of departure at a speed of twelve miles an hour.

After the tournament, Winsor negotiated a contract with the Russian government to build twelve torpedo boats at $25,000 apiece, and also obtained similar contracts from China and Japan. The company is now negotiating with the English government, which offers the Lay company a big contract, if the invention is proved to be superior to the English torpedo boat.

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Experiments with Wire.

From experiments by Mr. J. T. Bottomley, a report on which was read before the British Association at Sheffield, it seems that the prolonged application of stress has a very remarkable effect in increasing the strength of soft iron wire. Comparing the breaking weights for a wire quickly broken with those for the same wire slowly broken, it is found that in the latter case the strength of the wire is from 2 to 10 per cent higher than in the former, and is on the average about 5 or 6 per cent higher. The result as to elongation is even more remarkable, and was certainly more unexpected. In the case of the wire quickly drawn out, the elongation is, on the average, more than three times as great as in the case of the wire drawn out slowly. There are two wires for which the breaking weights and elongations are given in the tables accompanying the report, both of them "bright" wires, which showed this difference very remarkably. They broke without showing any special peculiarity as to breaking weight, and without known difference as to treatment, except in the time during which the application of the breaking weight was made. One of them broke with 44 lb, the experiment lasting one hour and a half; the other with 47 lb., the time occupied in applying the weight being thirty-nine days. The former was drawn out by 28·5 per cent on its original length, the latter by only 4·79 per cent. It was found during the breaking of the wires slowly—several months—that the wire becomes alternately more yielding and less yielding to stress applied. Thus, from weights applied gradually between 28 lb. and 31 lb. or 32 lb., there is very little yielding and very little elongation of the wire. For equal additions of weight between 33 lb. and about 37 lb. the elongation is very great. After 37 lb. have been put on, the wire seems to get stiff again, till a weight of about 40 lb. has been applied. Then there is rapid running down till 45 lb. has been reached. The wire then becomes stiff again, and often remains so till it breaks.

Suggestions for Discussion.

The American Society of Civil Engineers gives the following list of topics on which original papers are invited from members:

1. Topographical surveys, and the laying out of towns and the most economical divisions of property.
2. Instruments and methods of exact measurement for land surveys.
3. Trigonometrical and astronomical surveys.
4. Systems of road making and maintenance suitable for (*a*) large towns and heavy traffic; (*b*) suburban districts; (*c*) rural districts.
5. The sustaining power of different kinds of soils and the conditions which produce failure of foundations by settlement.
6. The weight which can be supported by different classes of masonry.
7. The preservation of masonry structures.
8. The manufacture of cements and methods of testing their strength.
9. The proportions of cementing and inert materials in mortars.
10. The preservation of timber used in construction.
11. The strength, durability, and characteristics of various timbers.
12. The manufacture of iron and steel in America. Combinations of materials, methods employed and plant used.
13. The properties and laws of cast iron, wrought iron, steel, and other metals used in construction.
14. The effect of constant or long continued vibration on metals used in construction.
15. The design, generally, of iron bridges of large span.
16. The construction and operation of drawbridges of large span.
17. Testing machines and experiments on the strength of materials and structures.
18. Appliances and methods of rock boring and blasting.
19. Sub-aqueous tunnels. Their design and construction.
20. The flow of water in channels of various kinds, and the modes of determining the discharge by experiment. Also the discharge over weirs and through orifices.
21. The loss of water in flowing in open channels.
22. The relations of rainfall, character of soil, and flow of streams; effect of wooded and of cleared and cultivated land on the flow of streams.
23. The sources of systems of water supply for towns, including storage of surface water, open wells, tube wells, gathering galleries, and ground water obtained from different geological strata.
24. Systems of water supply suitable for small communities, whether separately or co-operatively.
25. The detection and prevention of waste of water in towns.
26. The design, construction, and cost of operation of pumping engines, and mode of computing duty.
27. The history of the manufacture of cast iron water pipes in America.
28. The strength and dimensions of cast iron pipe and of wrought iron pipe for water supply. Forms of joints for water pipe.
29. Durability and cost of water pipe of cast iron, wrought iron and cement, wood and other materials.
30. The design and construction of earth embankments and masonry dams for reservoirs.
31. The construction, dimensions, and operation of navigable canals.
32. Methods of overcoming differences of level in canals.
33. The improvement and training of rivers.
34. The construction of harbors of refuge.
35. The construction of wharves, piers, and docks.
36. The construction of fireproof buildings.
37. Warming and ventilation of buildings.
38. House drainage.
39. The sewerage of towns and the disposal of sewage.
40. The form, material, and dimensions of sewers.
41. The economical location of railroad lines.
42. The construction and maintenance of the permanent way on railroads.
43. The form, manufacture, and life of rails.
44. The form and material of railway wheels.
45. The heating and lighting of railroad cars.
46. The prevention of accidents at railroad crossings and intersections.
47. Rapid transit in large cities.
48. The prevention of noise from heavy railroad trains moving at high speed.
49. Safe substitutes for animal power on surface railways.
50. The relative economy of the several kinds of fuel used in locomotive engines.
51. The operation of freight and passenger traffic on railroads, and the conditions of economy in the same.
52. The arrangement of terminal stations on trunk lines of railroads.
53. The manufacture, distribution, measurement, and use of illuminating gas.
54. Electricity as applied to lighting and to motive power.
55. The modern construction of water wheels and engines.
56. The engineering questions involved in the location and management of large industrial exhibitions.
57. Manufacture, strength, and durability of earthenware pipe.
58. The relations of engineers to employers and to contractors.
59. The status and compensation of experts.
60. Engineering and mechanical law.

Proposed Archæological Expedition to the Red Sea.

The editor of *Les Mondes*, the Abbé Moigno, is highly incensed at the criticisms of various scientists who seem skeptical about certain events narrated in the Scriptures, and especially so at Prof. Richard Owen, who, at a meeting of the Society of Orientalists in London, 1874, had the audacity to sweep away the Red Sea just where it is said to have been crossed by the Hebrews, in the following words: "The Isthmus of Suez is geologically a bridge of recent date between Asia and Africa; it was completed only during the last Miocene period. However recent this epoch be, from a geological standpoint, it is nevertheless remote enough to have allowed the forces which have given birth to species to establish degrees and distinctions between the great classes of animals living in the two respective seas which the isthmus separates. A zoological mind alone can appreciate the duration of the prehistoric time in question."

The Abbé Moigno now proposes to show men of Owen's way of thinking that they are in error. He believes the time has come to invite the whole Christian world to unite with him in a grand and noble enterprise—that of fitting out an expedition to go in search of the "eloquent remains of the Egyptian cavalry buried in the Red Sea, with their chariots, horses, horsemen, treasures, etc." He states it as his belief that these monumental remains will certainly be discovered by digging for them, and that they will be found in an excellent state of preservation owing to the action of the salt in which they are buried. It is proposed to form a sort of joint-stock company, the bonds to bear no interest, but the stockholders to be reimbursed by a division of the money proceeding from the sale of the discovered treasures. Subscriptions to the enterprise are to be sent to the office of *Les Mondes*, at Paris.

Disinfection of Mails by Dry Heat.

Inspector W. B. Winn, M.D., gives the following account of experiments at Memphis on the disinfection of mails by dry heat:

Thursday, September 4, the oven was adjusted, and old newspapers, letters, and mail-bags were placed in the hot-air chambers. After maintaining a temperature of 260° F. for thirty minutes, the papers and letters were found badly scorched; the mail-bags were uninjured. The failure being ascribed to draughts of air, the experiment was repeated, in-doors, the next day. At this trial the regular mail was exposed to a heat of 250° F. for one hour, without damage to any part thereof.

On Saturday, the sanitary policemen who had witnessed the previous experiments were placed in charge, and succeeded in burning a lot of newspapers and two mail-bags, sizes Nos. 3 and 4. This mishap was due to the manner in which the mail matter was disposed. Twenty-two sacks full, together with the bags, were crammed into the oven at once. The result was that the lower chamber became very hot, while only a portion of the hot air could enter the upper one. The thermometers are so arranged as to indicate the temperature of the upper chamber alone. When the burning occurred the thermometers registered only 213°; not one of the bags nor any portion of the mail in the upper chamber was injured.

Under proper supervision, and with due care, there is no danger of injury to the mails.

Sewing Machine Patents.

The expiration, last year, of some important patents on sewing machines, was followed by an immediate reduction in the prices of most of the machines used for family sewing, or in making the uppers of boots and shoes, and since then manufacturers have been anxiously looking forward to the time when the McKay patents on the sole sewing machine would run out. Of all the machinery at present used by shoe manufacturers, this sole sewer is probably the most important, as it is almost universally employed, and the tax for its use consists in a royalty averaging, probably, about two cents per pair on all goods made by it. This royalty is generally paid by affixing stamps, the price of which ranges from half a cent to ten cents per pair, the latter figure being for quilted boots and shoes, men's ordinary boots paying 4 cents, and shoes 3 cents, while women's pay 2 cents, and children's half a cent to a cent per pair. One of the leading patents on the machine, the one known as the "horn" patent, expired last month, and we had a number of inquiries from manufacturers who supposed that they would not thereafter have to affix the royalty stamps to the shoes they made. There are, however, many other patents on the machine, and the conditions under which machines are furnished to the manufacturers provide that the royalty shall be paid until *the last patent* has expired.

We have received from the McKay Association a statement as to the form of contract they make with manufacturers, and a mention of the duration of their patents, which we append. The important patents which expire in 1881, and without infringement of which they think it will be difficult to make a successful sole sewing machine, are: the shoe process, the expanding joint whirl, and the variable stroke. The first of these patents is on the making of a shoe by sewing directly, from the outsoles, through the upper and insole; the expanding joint whirl added greatly to the speed of the machine, and the variable stroke made it possible to sew with facility from a thick to a thin or a thin to a thick substance, and still keep an even tension. The following is a synopsis of "the situation," as presented by the McKay Association:

"There is some interest felt among manufacturers about the royalty on the McKay sewing machine. The contracts between the Sewing Machine Association and the manufacturers are of this nature: The machines are all owned by the association, the papers signed by all licensees clearly stating the fact; the leases require the payment of the full royalty as long as there is any patent on the machine, and that at the expiration of all the patents the lessee has the right (if he has kept the terms of the lease) to purchase the machine for $1; from this it seems that the expiration of any one or more patents on the machine is of no effect on the question of the right to use the machine without royalty, and it is only by the expiration of all the patents that that obtains. The principal agreements in the lease are these:

"1. A license to the licensee to use all the patents that are or may be put on the machine.

"2. An acknowledgment by the licensee that he has no right in the machine except as a lessee.

"3. That the royalty shall be 10 cents a pair, with a proviso that if the lessee stamps his shoes as soon as they are finished, and before boxing or exposing for sale, the stamp shall be in lieu of the royalty for the shoes so stamped.

"4. That the contract and payment of royalty, and all its obligations, shall continue as long as there are any patents on the machine, and that when all are expired the lessee can buy the machine for $1 if he has kept all the terms of the lease.

"5. That owners of the patents have the right to cancel the lease and take away the machine if the terms of the lease are not kept; that there is nothing in the lease which compels the lessee to use the machine, but as long as he uses it the terms of the contract are in active force.

"The dates of the patents are on all the machines; the latest patent expires in 1887. The patents which run till 1882 are considered so strong and important that it is confidently believed the machines will be used, and the full royalty paid, till then; those after that date are not essential, though of great value."—*Shoe and Leather Reporter.*

American Enterprise.

Word comes to us from across the water that W. G. Wilson's visit to Europe was to make arrangements for the manufacture of the New Wilson Oscillating Shuttle Sewing Machine in England for the European market, and that the well known "Wellington Works," of Oldham, near London, owned by a stock company known as Bradbury & Co. (limited), for the manufacture of the Singer, Howe, Wheeler & Wilson, and Wellington sewing machines, since 1850, have been secured for the manufacture of the Wilson Oscillating Shuttle Sewing Machines exclusively hereafter. An interview with Mr. Sheldon, the general manager of the Wilson Sewing Machine Company, elicited the fact that our information is correct, and that this course was absolutely necessary in consequence of the incapacity of the company's large works at Grand Crossing to turn out a sufficient number of Wilson sewing machines to supply the American market.—*Sewing Machine Advance.*

ERRATA.—In article on "Toadstool Poisoning," page 229, second column, 29th line, "amorphous black mass" should read "amorphous *brown* mass;" in line 49 of the same column "flavoring plants" should read "*flowering* plants."

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The Secret Key to Health.—The Science of Life, or Self-Preservation, 300 pages. Price, only $1. Contains fifty valuable prescriptions, either one of which is worth more than ten times the price of the book. Illustrated sample sent on receipt of 6 cents for postage. Address Dr. W. H. Parker, 4 Bulfinch St., Boston, Mass.

The Baker Blower runs the largest sand blast in the world. Wilbraham Bros., 2318 Frankford Ave., Phila., Pa.

Forsaith & Co., Manchester, N. H., & 213 Center St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

H. Prentiss & Co., 14 Dey St., New York, Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

The Horton Lathe Chucks; prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 206.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Band Saws a specialty. F. H. Clement, Rochester, N. Y

Diamond Planers. J. Dickinson, 64 Nassau St., N. Y.

Patent Steam Cranes. See illus. adv., page 222.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

Vertical Engines. F. C. & A. E. Rowland, New Haven, Ct.

Draw'g Insts. & Mat. Woolman, 116 Fulton St., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Noise-Quieting Nozzles for Locomotives and Steamboats. 50 different varieties, adapted to every class of engine. T Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel — other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

The New Economizer, the only Agricultural Engine with return flue boiler in use. See adv. of Porter Mfg. Co., page 206.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Cut Gears for Models, etc. (list free). Models, working machinery, experimental work, tools, etc., to order. D. Gilbert & Son, 212 Chester St., Philadelphia, Pa.

Walrus Leather and Bull Neck for Polishing all Metals. Greene, Tweed & Co., 18 Park Place, New York.

Oak Tanned Leather Belting, Rubber Belting, Cotton Belting, Polishing Belts. Greene Tweed & Co., N. York.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of this week.

Pays well on small investments; Magic Lanterns and Stereopticons of all kinds and prices: views illustrating every subject for *public exhibition and parlor entertainments*. Send stamp for 80 page Illustrated Catalogue. Centennial medal. McAllister, 49 Nassau St., New York

Fine Taps and Dies in Cases for Jewelers, Dentists, and Machinists. Pratt & Whitney Co., Hartford, Conn.

Deoxidized Bronze Patent for machine and engine journals. Philadelphia Smelting Co., Phila., Pa.

Wheels and Pinions, heavy and light remarkably strong and durable. Especially suited for sugar mills and similar work. Circulars on application. Pittsburg Steel Casting Company, Pittsburg, Pa.

Hand Fire Engines, Lift and Force Pumps, for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y. and 93 Liberty St., N. Y. city, U. S. A.

Steam and Gas Fitters' Tools a specialty. Send for circulars. D. Saunders' Sons, Yonkers, N. Y.

Wm. Sellers & Co., Phila., have introduced a new Injector, worked by a single motion of a lever.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

NEW BOOKS AND PUBLICATIONS.

REPORT ON PRELIMINARY INVESTIGATION OF THE PROPERTIES OF THE COPPER TIN ALLOYS. Washington: Government Printing Office. 1879.

This report of the committee on metallic alloys embraces the results of the first complete and systematic researches ever made upon copper tin alloys, the most important of all the alloys of the useful metals. The investigation was entered upon under a resolution of the United States Board to test iron, steel, and other metals, passed April 17, 1875. The special work of the committee was begun in 1877, under the direct supervision of the chairman of the committee, Professor Robert H. Thurston, who edits this report. The work, which determined approximately the mechanical properties of all alloys of copper and tin, was done in the Mechanical Laboratory of Stevens Institute of Technology, Hoboken. The aim of the committee has been to ascertain the practical value of commercial metals to the brassfounder and the constructor, when treated in the ordinary manner, the investigation of the effect of various kinds of fluxes and methods of fluxing, and of special methods of treatment of the alloys after casting, being reserved for future research. Six plates show photographs of fractures of copper tin alloys; and twenty-one plates are devoted to graphical representations of the physical properties of the same alloys; and fifty-four plates give facsimiles of the autographic strain diagrams of tests by torsion. There is appended a number of selected papers on the metallic alloys; a review of the earlier researches on the properties of the metallic alloys, with lists of authorities in the department of research; and translations of the elaborate researches of Alfred Riche and M. G. Wertheim.

ZEITSCHRIFT DES ARCHITECTEN UND INGENIEUR. Vereins zu Hannover. Vol. 25, No. 3. Hannover: Carl Rümpler. 1879.

The third number of the 25th volume of the above publication is now before us. It contains the plans of the new building for the Technical High School at Hanover. The same was to be the residence of the former king, but as it was never finished, the Prussian government had the same reconstructed and transformed into one of the most handsome of college buildings. It is built entirely of light sandstone, is about 520x380 feet, has four towers, and is 3 stories high. The drawings, details of construction, estimates, and description of the Carola Bridge which spans the river Elbe at Schandu, Saxony, are also given. This handsome bridge is arranged for a railway, vehicles, and pedestrians, and consists of 3 semi-parabolic wrought iron trusses resting upon stone abutments and piers. A detailed article on the different means for the prevention of rust on iron, by Dr. J. Treumann, and extracts from all technical and patent journals, constitute the remainder of the work.

DETERMINACION DE LA LONGITUD DEL PENDULO DE SEGUNDOS Y DE LA GRAVEDAD EN MEXICO. Por Francisco Jimenez y Leandro Fernandez. Mexico: 1879.

The determination of the length of the seconds pendulum has two applications of the greatest importance; first, to find by various methods of comparison, the law of variation in length of several synchronous pendulums in different places, and to deduce therefrom the level of the terrestrial spheroid and consequently its form; and second, to determine the force of gravity, this being calculated at double the space described in the first second of its motion by a body falling in vacuo from a state of rest. Notwithstanding the importance of the determination of the length of the seconds pendulum, no observation of this kind has been made in Mexico until quite recently, when it was undertaken by the two engineers, Señores Jimenez and Fernandez. The results of the labors of these two gentlemen are recorded in the pamphlet before us, which forms one of the series of the valuable scientific memoirs that are being issued from time to time by the Mexican government. Without following the authors into the intricate calculations which are given *in extenso* in their memoir, we may state as the result of their labors, that the length of the seconds pendulum at the sea level was found to be 0·99153 m. and at the observatory 0·99109 m.; force of gravity at the sea level 9·7860 m., and at the observatory 9·7816 m. The geographical position of the observatory at the city of Mexico was thence found to be as follows. Latitude, 19° 26′ 1·3″ N.; longitude east from the meridian of Greenwich 6h. 36m. 26·67s.; height above the level of the sea 2,283 meters. The authors state that their results are of so much the more interest in that the pendulum experimented with was more than 12 meters in length, something uncommon in pendulums designed for this class of experiments.

ETUDE SUR LES ALLIAGES DE PLOMB ET D'ANTIMONIE. Par F. de Jussieu, Autun (France), 1879.

A brief but complete study of the alloys of lead and antimony, giving their compositions, and describing their physical and chemical properties, and their phenomena of liquation and supersaturation. The study of the subject of liquation (the causes of which are here satisfactorily explained) is so much the more interesting in that the phenomena connected therewith often prove a source of trouble, vexation, and unsuccess to type founders, stereotypers, and others who are accustomed to manipulate the alloys in question. To the latter class of readers, therefore, the pamphlet will prove especially valuable.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) H. H. C. asks: Can books be obtained giving instructions in lithography or photo-lithography, or both; if so, where? A. Yes, address the booksellers who advertise in this paper.

(2) I. F. R. asks (1) whether any kind of battery is necessary in using the telephone. A. Batteries are used where a transmitter is employed. 2. Which is best for a small engine, a common upright tubular boiler or a simple coil boiler made of ¾ inch gas pipe? Is there any danger of the coil getting stopped with sediment. A. An upright tubular boiler. The ¾ inch coil pipe will be liable to stoppage and burn out.

(3) E. J. T.—You will oblige by giving the best receipt for making violin varnish. A. Coarsely powdered copal and glass, each 4 oz.; alcohol, 64 o. p., 1 pint; camphor, ½ oz.; heat the mixture, with frequent stirring in the water bath so that the bubbles may be counted as they rise, until solution is complete, and when cold decant the clear portion. When oil varnish is used it is made as for *artists' virgin copal*.

(4) H. J. writes: I have a lot of silver plated spoons. I would like to take the silver from them. How can I do it and save the silver? A. Dissolve 1 lb. of saltpeter in about 8 lb. of sulphuric acid by aid of heat. This (hot) solution will strip or dissolve off the silver plate. The silver may be recovered from its solution by the addition of salt, which precipitates it as chloride, and this, dried and fused with a small quantity of carbonate of soda, or borax and niter, gives pure metallic silver.

(5) G. J. McK. asks: 1. Can you give me a satisfactory process for waterproofing cloth? A. Saturate the fabric with a strong hot aqueous solution of soap, press out excess, and transfer to a second bath consisting of a strong aqueous solution of sulphate or acetate of alumina or acetate of lead, for several hours Repeat if necessary, press out excess of liquid, and dry, not too rapidly, in the air. 2. Can you give me a process for determining quantitatively the presence of cinchonidine as an adulterant of quinine? A. Five to ten grammes of the mixed alkaloids are mixed with 50 grammes of ether, and the mixture, after well shaking, left at rest until next day. By this operation the alkaloids are separated into two parts: one soluble in ether, and another insoluble in that liquid. The part soluble in ether contains the quinine, while the insoluble part contains the cinchonidine. These two parts are separated by a filter, the insoluble part washed with some ether, and the ethereal solution evaporated. This insoluble part is now mixed with 40 parts of hot water, and converted into neutral sulphate by careful addition of diluted sulphuric acid, so that a solution is obtained having a slight alkaline reaction upon red litmus paper. To this solution a solution of tartrate of potash and soda is added in sufficient quantity to convert the sulphates into tartrates, and after stirring with a glass rod, allowed to remain for 24 hours. If cinchonidine be present in appreciable quantity, its tartrate will be found separated in crystalline form. The tartrate of cinchonidine is collected upon a filter, washed with a little water, and dried on a water bath. One part of this tartrate represents 0·804 part of cinchonidine.

(6) W. M. E. writes: In your issue of September 20, No. 25, "Tropic" asks for something to absorb the moisture in dry room and run it out. Suppose he places coils of gas pipe, like steam heating, and place a gutter under bottom, and then force cold water through the pipes, would not all the moisture be condensed upon the pipes and drop into the gutter and run off? Could not chemicals be used in pipes instead of water to keep them cold? A. The plan proposed would mitigate the evil. Chemicals might also be used, but they would probably require too much attention and be expensive. 2. My engine exhaust pipes are 10 feet long, with 3 inch bore, run nearly on 70 to 80 lb., with 100 to 120 revolutions per minute. My sawyer says he can run 1¼ inch pipe from the feed pump around and through both exhaust pipes and then into boiler and heat the water so as to save fuel. Will it do so? Would it interfere with the proper action of the exhaust steam? A. The plan proposed by your sawyer would be successful, but the same result can be attained by using the ordinary coil heater, and we think be less expensive.

(7) J. H. writes: I have Roper's book on the steam engine. I wanted to calculate the horse power of an engine, 16 inch cylinder, 2 foot stroke, making 100 revolutions a minute, steam boiler pressure being 100 lb. to square inch. I was somewhat puzzled. Will you give an explanation? Cylinder, 16 inch; area of cylinder, 201·0624; velocity of piston in feet, 400; mean pressure on piston, cut off at half stroke, 79 lb. A. You say the boiler pressure is 100 lb. Is the initial pressure in the cylinder 100 lb.? If so, then 201×79 lb. = 15,879 lb. pressure on the piston, moving at 400 feet per minute, 15879×400=6351600 and $\frac{6351600}{33000}$=192·4 horse power, less 20 per cent for friction and other losses=192·4 less 38·5=153·7 horse power.

(8) J. M. G. writes: In your last issue, one of your subscribers asked for information as to size of discharge pipe for a hydraulic ram. I have found that it depends a great deal upon the distance the water has to be forced, the amount of pressure in the supply pipe, etc. It is obvious that where there is considerable pressure in the supply pipe, and only a short distance to drive the water, a much larger discharge pipe will be required than if these conditions were reversed. There is a very simple contrivance for increasing the capacity of a hydraulic ram, which I do not think is generally known. It is this: Drill or file a small hole, say 1-32 of an inch in diameter, in the supply pipe, about a foot above the place where it enters the ram. At every stroke of the ram a small stream will be discharged from this orifice. This at first sight would seem to decrease the power rather than augment it, but when the reaction takes place in the pipe there seems to be a small quantity of air sucked in, and this air is probably liberated from the water when it reaches the air chamber, thus increasing the pressure. At least this seems to me the most feasible explanation. Certain I am that I have repeatedly tried this plan and find it to increase materially the power of the ram.

(9) J. A. S. asks: 1. What would be the best and cheapest piping for conveying strong salt water, say 5 or 6 inch stream, for a distance of 5 or 6 miles? A. Wood tubing, also enameled iron conduits, are in practical use for such purposes, and have, we believe, proved most economical. 2. Is there a work published giving the different systems of water works: if so, where can it be had and what would be the cost? A. There are a number of good works on this subject. Address for catalogues the book dealers who advertise in these columns.

(10) C. E. R. asks: How can I cover copper wire with gutta percha, suitable for use in a gravity battery? A. By wrapping the wire with a thin strip of gutta percha. The wire should be warmed.

(11) J. P. writes: I want a cheap paint varnish or other coating for the insides of paper boxes, so that they will hold a compound containing linseed oil. Glue is too brittle. Also, a cheap coating for such boxes whereby they will hold water, or one that will hold either water or oil; a somewhat elastic coating is desirable. A. You may try the following: Borax, 1 part; shellac, 4 parts; water, *q. s.* Boil to form a sirupy liquid. Apply hot. This may be used alone or mixed with the glue solution and a little glycerine.

(12) T. D. M. writes: We have a short telegraph line (about one and a half miles) between our office and factory, which connects telephones. It is often impossible to hear, from the crackling noise in the telephone from earth currents, or it may be a too near proximity to various police and fire telegraph lines which we cross on the road. Is there any way in which we could empty our line of electricity so that we can hear with the telephones we have (Duquet's)? We use an electro magnetic machine for signaling. A. Use one of the forms of carbon transmitter in connection with an induction coil.

(13) J. T. N. asks: What are the best non-conductors of heat? What I mean is something that, placed in contact with heated metal, will not heat (a stove pipe for instance) nor crack. A. Plaster of Paris and sand; asbestos; a metallic jacket filled with sand; terra cotta.

(14) A. C. gives the following receipt for preserving cider sweet: Make cider of good sound apples, let stand about three days, rack off, strain through flannel or charcoal and sand, put in clean barrel, and to each barrel add one quart grated horse radish, bung tight; this will keep it sweet, and after three or four weeks it will have a very pleasant flavor; you will scarcely notice the horse radish taste in it. [A much smaller quantity of horseradish will suffice. Sulphite of lime (calcium sulphite) is now used instead.] See article on "Preservation of Cider," p. 81, current volume of SCIENTIFIC AMERICAN.

(15) H. W. asks: 1. Why was the distance from the pole to the equator chosen as the basis of the metric system, in preference to some certain sized (that is, certain timed) pendulum, or the quadrant of the equator? A. Because the English had previously adopted the pendulum standard. 2. Is there any other natural basis for a system of measures except the pendulum and the size of the planet? A. Many nations have adopted standards based on the human body or its members. 3. What, according to the latest measurements, is the distance from the pole to the equator, expressed in meters? A. 10,001,850 meters. The original French survey gave a distance equal to 10,000,000 meters; that is 1-10,000,000 of the calculated distance was called 1 meter. More extended geodetical measurements have proved the length of the meridional quadrant to be as above. The meter is 1-5400 short.

(16) M. L. B. writes: A friend has a new steam engine, 8x12, 150 revolutions, 70 lb. pressure; I tell him it is a 25½ horse power engine. But he only runs a small lathe under these conditions. He ships on a planer and something else, and the revolution is slowed down to 75 revolutions. I then tell him it is a 12¾ horse power engine; but he then ships on more machinery, and its revolutions are only 37½. I have now to confess that, by the rule, it is only a 6⅜ horse power engine, that is, the more work it does the less capable of doing work it is supposed to be; or, in other words, when it shows itself to be most powerful the lower it is rated. What is its horse power? A. The amount of power

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exerted by a steam engine depends upon the resistance opposed to it and not upon the pressure of steam in the boiler. When your friend is running his small lathe only, the pressure required on the piston is probably less than 10 lb. per square inch; when he adds the planer it may be 15 or 20 lb. per inch; and so with every increase of resistance the pressure on the piston, hence also the power is increased. You will find this clearly explained in "Pambour's Theory of the Steam Engine."

(17) R. F. M. asks: Is there any formula for calculating the power of the "hydraulic ram;" if so, what is it? (Ram for lifting water.) A. The manufacturers' rule is: Multiply the quantity supplied by the spring (in gallons per minute) by 65. Multiply the product by the head or number of feet fall, then divide this product by 100 times the height to which the water is to be elevated; the result will be the quantity of water raised per minute.

(18) H. W. asks how to make a fulminate suitable for coating the inside of a toy so that if it is struck with a pointed instrument it will explode. A. Mercury is dissolved in 12 parts of nitric acid of 35° to 40° B., and to the clear solution is gradually added 11 parts of alcohol at 0·86. The crystals of fulminate, which separate after the reaction is completed and the liquid cooled, are washed with cold water, allowed to drain until the mass contains about 20 per cent of water and then cautiously mixed with 3-5ths its weight of niter, by means of a soft wooden muller, to form a paste, in which form it should be applied in the cartridge and allowed to dry. It is an exceedingly dangerous substance to handle on account of its explosibility, and the greatest caution has to be observed to avoid accidents.

(19) J. W. G. asks: 1. What gases escape up the chimney of a furnace burning soft coal? A. Carbonic acid, carbonic oxide, water, and various hydrocarbons, besides sulphurous acid and nitrogen. 2. Has any attempt ever been made to utilize them again as fuel? A. Yes, there have been a number of devices patented, and a few are in successful use. 3. What proportion of the heat in soft coal is converted into force with the best constructed furnace and engine? A. About 11 per cent. 4. What proportion of the loss goes up the chimney? A. The loss is variable.

(20) D. H. writes: I have a steam yacht hull, 32 feet long, 7 feet beam, which draws 3 feet 2 inches. What size engine and screw do I need? A. 4½ inch cylinder by 6 inch stroke. Screw 32 inches diam. 2. What kind of a boiler will be best for salt water? A. Horizontal tubular. 3. Are the coil boilers practical? A. Coil boilers are not good for constant use.

(21) M. E. J. asks for an inexpensive method of oxygenating water. A physican here advertises to treat patients with it, but I believe the process he employs is not patented. He calls his compound "oxygen aqua." A. It is probably a dilute solution of peroxide of hydrogen.

(22) H. J. H. asks for a good receipt for cleaning gilt frames. I am a constant reader. A. Clean with a soft sponge moistened (not too well) with spirit of wine. Allow to dry by evaporation; do not use a cloth, and avoid friction.

(23) J. F. S. asks: What chemicals can be used (in cold or warm water) to soften yarn, which has become hardened by being worked on a knitting machine, without injuring the color of the yarn? A. Probably, try a little ammonia water.

(24) C. A. C. asks for a receipt for solvable glass for using on decorative pottery. A. Mix well together 2 parts fine sand and 6 parts of carbonate of potash (or 3½ of carbonate of soda) in a crucible capable of holding 4 times as much. Carbonic acid escapes, and the contents fuse together to form a glass. Pour this on an iron plate, and when cold dissolve it in boiling water to form a sirupy liquid.

(25) F. S. writes: 1. I would like to know how to preserve natural flowers without taking the color out. A. See p. 409 (7), Vol. 40, SCIENTIFIC AMERICAN. 2. A cement for bottles? A. See recipe No. 22, p. 2511, No. 158, SCIENTIFIC AMERICAN SUPPLEMENT.

(26) R. A. J. asks: 1. How many primary or simple elements are there in nature? I claim over sixty; a friend of mine says that only four exist, namely, oxygen, nitrogen, hydrogen, and carbon; who is right? A. About 60 elementary bodies have thus far been discovered. 2. Can air be weighed without a vacuum? A. As we understand you, no. 3. I have an old soda fountain, cast of brass and soldered together in the center; would it be safe to use it for a steam boiler for a model engine? A It would not make a safe boiler.

(27) A. C. F. asks (1) how to make a Grenet battery. A. A Grenet battery consists simply of one or two plates of battery carbon and a plate of amalgamated zinc, plunged in a solution consisting of bichromate of potash 2 parts dissolved in 20 parts of hot water; and sulphuric acid 1 part, to be added after the solution becomes cool. See SUPPLEMENTS, 157, 158, and 159. 2. Why is the wire curled like a spring where it connects the battery? A. To render it more flexible. 3. How can I make a simple armature? A. Any piece of soft wrought iron makes an armature.

(28) H. F. G. asks whether or not the steamers descending the rapids of the St. Lawrence river shut off steam and go by means of the current alone; if so, how do they steer the boat? A. At some of the rapids the pilots do shut off steam partially but not wholly; they still have progress enough through the water to give them steering control.

(29) C. H. H. asks: 1. Is a good locomotive engineer capable of performing the duties of an engineer on our Western river steamers? A. If his experience has been confined to locomotives, no. 2 Does an engineer necessarily have to have an understanding of algebra or geometry, or is a good understanding of arithmetic (higher) sufficient? A. For what is called a running engineer, arithmetic is sufficient, but for the higher grades of engineers, algebra and geometry are almost a necessity.

(30) H. D. asks what proportion the grate surface should bear to the heating surface of a steam boiler. A. 1-25 to 1-30.

(31) C. B. M. writes: 1. I want to make an electro-magnet of 150 ohms: how much of No. 30 copper magnet wire will be required? A. Of No. 30 by B. W. G., you will require 1,100 feet. 2. Is there any rule by which I can tell the number of ohms in a magnet, knowing the size and amount of wire in magnet? A. It cannot be accurately determined by rule, as the resistance of different samples of wire varies. The readiest means of obtaining the resistance approximately is to use the tables given in most works on electricity.

(32) J. A. S. asks: 1. What is the best and cheapest piping for conveying a 5 or 6 inch stream of strong salt water, say a distance of 5 or 6 miles, to avoid rusting and corroding? A. Use wooden pipes or enameled iron tubes. 2. Is there a work published on water systems: if so, where can it be had and what is the cost? A. For such works as you require address publishers who advertise in our columns.

(33) W. M. asks: 1. How much will air expand by heating; for example, force into a boiler 40 lb. of air to the square inch, how many lb. to the square inch will it be when the fire is 212° F? A. Air expands about 1-490 for each degree of increase of temperature.

(34) A. J. B. asks: 1. What is the greatest depth from which sunken vessels have been raised, time it took, cost, and by what means raised? A. Perhaps some of our readers can furnish the information. 2. Please tell me how to make a simple microphone. A. See SUPPLEMENT, No. 163.

(35) E. W. writes: A friend and myself intend to build a small stern wheel steamboat, and wish you to assist us if it is in your power. The dimensions of boat are: 25 feet in length, 7 feet wide at deck, and 4 feet wide at bottom (flat), and 3½ feet deep. What size boiler, tubes, number and size, will be required to propel this boat not less than 8 miles an hour. Would the following proportions do: size of wheel about 5 feet diameter, and 3 feet wide; engines, 2x4 inches; with gearing of 1 to 2, connecting shaft of cog wheel to shaft of driving wheel, by connecting rods, with cranks set at right angles? A. We judge from your letter that you intend a side wheel boat; if so, and one engine geared 2 to 1, it should be at least 3 inches diameter by 6 inch stroke. The wheels need not be more than 24 inches wide. If you have two engines, they may be 2¼ inch by 6 inch stroke; work with a power on crank shaft into a spur wheel on wheel shaft. Your boiler should have about 75 to 80 feet surface.

(36) F De C. writes: 1. Suppose you have a perfect balance: on one scale you place a cylinder filled with steam, 10 atmospheric pressures; on the other you put a weight equal to this cylinder, so that the equilibrium shall be re-established. Now, by some means you open an aperture one inch square which is at the top of the cylinder, allowing the steam to escape during one second (of course you close the aperture after the second has elapsed). Will the reaction power, of the escaped steam during one second lift the other scale? A. At first instant of time, yes, but very soon the loss of the steam will turn the scale the other way. 2. Could you state what amount of steam has escaped in this one second? A. The amount of steam could be calculated, but full data would be required.

(37) S. G. S. asks for the best way to temper drills for drilling granite rock. A. See directions for tempering mill picks, p. 219, Vol. 39 the same process will apply to your drills.

(38) A. W. P. asks: 1. How much lead should the cut-off valve have on a small engine, 8 horse, cylinder 5x12, cut-off at full stroke, 200 revolutions per minute? A. If a single port cut-off valve, 1-16 inch; if a double port valve, a little less than 1-16 inch. 2. Is an instrument to be had that will assist in finding hidden valuables, such as gold or silver; if so, where to be found? A. No.

(39) W. asks how to make a good quality of shellac varnish. A. Take shellac, any quantity, put it in a glass jar or tin vessel, and add alcohol to just cover the shellac. Set in a warm place, beside a stove or even in the sunshine, and in two or three days it is fit for use. If too thick add alcohol. It is not necessary to strain, as impurities will settle to the bottom of the vessel. Keep covered to keep out dust. If closely corked, evaporation of the alcohol will be very small. It can be used for wood, brass, iron, paper, etc. Experience will determine the proper thickness of the varnish.

COMMUNICATIONS RECEIVED.

On the Use of Brimstone in Fastening Iron to Foundations. By F. W. B.

On the Classification of the Protista., By H. M. D.

On Jupiter's Spot. By J. A B.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

September 16, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Albumen from fish spawns, making, T. O. Alsing. 219,667
Axles, machine for cutting and screw-threading vehicle, A. L. Lincoln 219,641
Bake pan, C. Jackson 219,731
Bale pressing and sacking device, W P Groom 219,718
Bale tie, W. Hill 219,724
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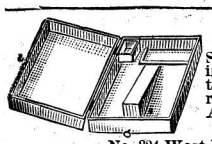

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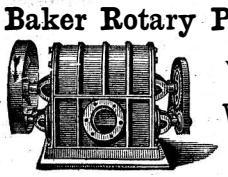

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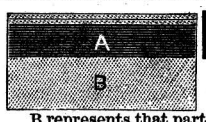

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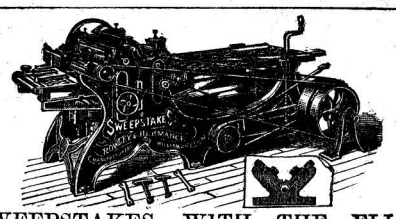

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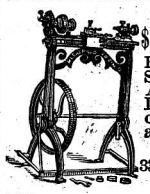

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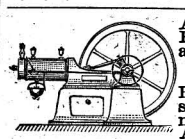

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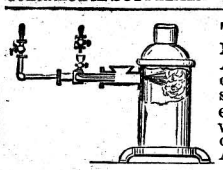

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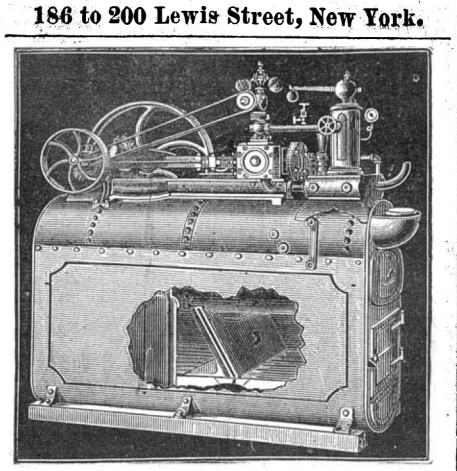

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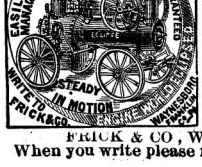

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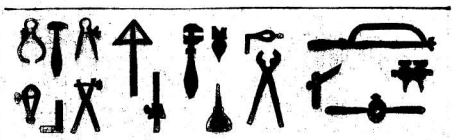

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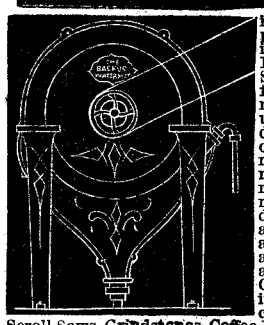

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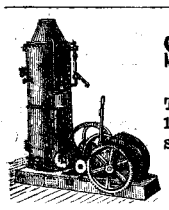

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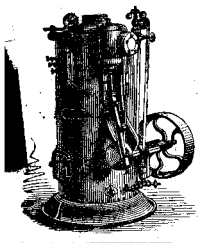

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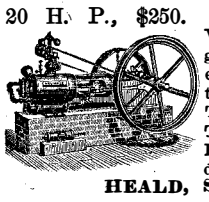

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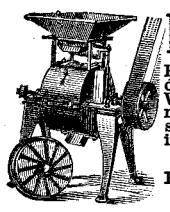

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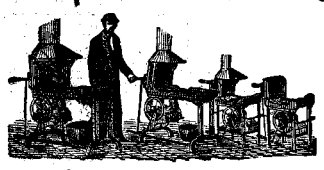

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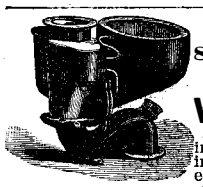

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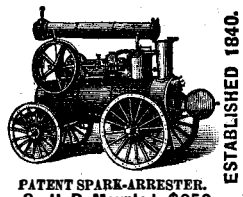

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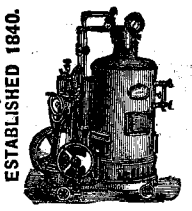

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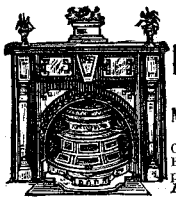

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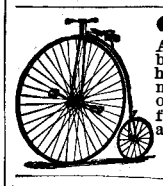

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